LELY Discovery 90 SW
Mobile Barn Cleaner

Operator Manual

5.4006.8501.0 - Lely Control

EN - English Original

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Lely Industries N.V.
Cornelis van der Lelylaan 1
3147 PB Maassluis
the Netherlands
Phone: +31 (0)88 1228221
Fax: +31 (0)88 1228222
Website: www.lely.com

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WARRANTY RESTRICTIONS

Excluded from this warranty are any cost or expenses due to:

- Abnormal use of the equipment which is not according to the specifications stated in the Operator Manual or handled during the Operators Service and Maintenance Certification program.
- The result of any intervention by technicians other than Lely service technicians or technicians who have Lely's approval to perform certain duties.
- Incidents such as freezing, ice, fire, flood, inundation or any other form of excessive water, lightning.
- Defect of the electrical system or grounding.
- Hacking activities, viruses or the like.
- Damage to the electrical system as a result of vermin or the like.

Warranty does not apply to consequential damage which does not involve the machine itself.

All systems are tested. However in the event of a malfunction Lely cannot be held responsible for consequential damage.

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LIST OF INCLUDED AMENDMENTS

No:	Issue Date (yy/mm)	Chapter(s)	Remarks
2	14/06	All	Bluetooth operation added Pause button added Operator manual separated
1	12/11	All	Full revision of the manual - Hardware changes are incorporated
	11/02		Initial issue

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PREFACE

Manual Contents

This manual contains the information necessary to operate the Discovery Mobile Barn Cleaner 90 SW.

Study and understand this information thoroughly before you operate the Discovery Mobile Barn Cleaner 90 SW. Failure to do so could result in personal injury or damage to equipment. Please consult your local Lely service provider if you do not understand the information in this manual, or if you need additional information.

All information in this manual has been compiled with care. Lely shall not be liable for errors or faults in this manual. The recommendations are meant to serve as guidelines. All instructions, pictures and specifications in this manual are based on the latest information that was available at the time of publication. Your Discovery Mobile Barn Cleaner 90 SW may comprise improvements, features or options that are not covered in this manual.

Applicability

The table below shows the type numbers of Discovery for which this manual is applicable and the software version the procedures are based on.

Model designation

Model	Type number
Discovery Mobile Barn Cleaner 90 SW	5.4006.0020.1

Software version

The description, operation and procedures in this manual are based on the software version:

- ADS 3840 PCB: DISSv04.08.XX
- ADS 3641 PCB: 1.2.41 or higher
- Lely Control app Android: 1.2.23 or higher.

Standard Torque Loading of Parts

All the nuts, bolts and screws used on the Discovery Mobile Barn Cleaner 90 SW are torque tightened to standard torque loadings applicable to the construction materials used.

If a part has a non-standard torque loading, it is specified in the applicable part of the manual.

Registration

The Type and Serial Number Plate is attached to the upper side of the frame of the Discovery Mobile Barn Cleaner 90 SW, under the red cover. Always

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include the type and serial numbers of Discovery when you contact your local Lely service provider or order spare parts.

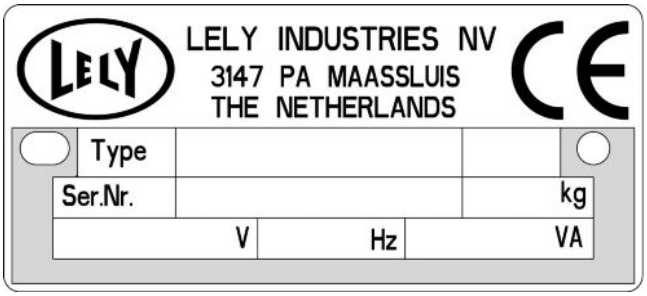

Figure 1. Type and Serial Number Plate

We suggest you complete the table below with the type and serial numbers of your Discovery. This makes sure you can easily find the information.

Type number	5.4006.0020.1
Serial number	

Maintenance Authorization

Only technicians certified by Lely Industries are authorized to do corrective maintenance on the Discovery.
If people who are not certified by Lely Industries do maintenance on the Discovery, the warranty on the Discovery becomes invalid.

Before a technician does maintenance on an Discovery, the owner must examine the service pass of the technician and make sure the technician is currently certified to do maintenance on the Discovery.

When a technician completes maintenance on an Discovery the information must be written in the logbook for the Discovery. The logbook must always be kept near the Discovery. The information in the logbook must include:

- The maintenance done
- The name of the technician
- The certification number of the technician
- The date of the maintenance.

Technician Training

All the technicians certified by Lely Industries have completed an approved training program, and passed written and practical examinations during and at the end of the training program. The examinations are done under supervision of a product specialist and include troubleshooting and corrective maintenance of the Discovery.

There are four certification levels:

- Installation Technician (certification valid for two years)
- Maintenance Technician (certification valid for two years)
- Service Engineer (certification valid for two years)
- Product Specialist (certification valid for one year).

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During training, a trainee is permitted to work for up to a maximum of six months on an Discovery in the presence of a certified technician.

When the training program is completed successfully, Lely issue a certificate and a service pass to the technician. The service pass contains the following information:

- The name of the technician
- A photograph of the technician
- The certification number of the technician
- The date of expiry of the certification.

Contact Number Local Service Provider

We suggest you write the telephone number and email address of your local service provider contact in the table below. This makes sure you can easily find the information.

Telephone number	
email address	

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1. INTRODUCTION

The Discovery Mobile Barn Cleaner 90 SW is a battery-driven vehicle that cleans the floor of a barn. Two nozzles spray water on the floor before a manure scraper on the bottom of the Discovery pushes the manure through the openings of the slatted floor.

The farmer (operator) uses the Lely Control app on the smartphone to program the route for the Discovery. Routes can be programmed flexibly. The farmer has the option to do more intensive cleaning of some areas of the barn during certain hours of the day.

The information in this manual is for operators. The operator uses the information to program and operate the Discovery. The operator also uses the information to do maintenance.

The operator must read the operating instructions for daily operation and for the setup of routes and time paths. He must read the test and adjustment section for the setup and for testing the Discovery and routes. He must also read the maintenance and troubleshooting sections for preventive and basic corrective maintenance instructions.

The operator should refer to the description and the operation section for background information. The operator must also read and understand the safety instructions in section 'Safety'.

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2. SAFETY

2.1 Introduction

The Discovery Mobile Barn Cleaner 90 SW is an automated machine. Therefore it is of the utmost importance to obey all safety instructions.

The safety alert symbol identifies important safety messages on your Discovery Mobile Barn Cleaner 90 SW and in the manual. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instruction of the safety message.

Safety Alert Symbol

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2.2 Signal Icons

Note the use of the signal words DANGER, WARNING and CAUTION with the safety messages. The signal word for each message uses the following guidelines:

Danger: indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

Warning: indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed.

Caution: indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury or product or property damage.

Note: this shows extra information that may help the reader.

2.3 Safety Instructions

YOU are responsible for the SAFE operation and maintenance of your barn cleaner. YOU must make sure that you and anyone else who is going to operate, maintain or work in the vicinity of the barn cleaner knows all the related SAFETY information in this manual.

YOU are the key to safety. Good safety practices protect you and the people around you. Make these practices a working part of your safety program. Make sure EVERYONE who operates, maintains or works near the

Discovery obeys the safety precautions. Do not risk injury or death by ignoring good safety practices.

- Discovery owners must train operators before they operate the barn cleaner. This training must be repeated at least annually
- The operator must read, understand and obey all safety and operating instructions in the manual
- A person who has not read and understood all safety and operating instructions is not permitted to operate the barn cleaner
- Do not modify the equipment in any way. Unauthorized modification may impair the function and/or safety and could affect the life of the equipment, and persons
- Only use approved spare parts, and make sure they are only installed by authorized technicians.

2.3.1 General Safety

- When the water filling station is connected to the drinking water system, a header tank **must be** installed between the drinking water system and the water filling station to prevent the pollution of potable water by backflow of water with bacterial contamination
- Read and understand the manual and all safety signs before you connect power supplies to operate, maintain or adjust the Discovery
- Only trained persons are permitted to operate the Discovery
- A first-aid kit must be available near the Discovery. Store in a highly visible place
- A carbon dioxide or foam fire extinguisher must be available near the Discovery. Store in a highly visible place
- Install all protective covers and guards before you operate the Discovery
- Wear the correct protective clothing and equipment
- Disconnect and isolate the electrical power supply and wait for all moving parts to stop before you clean or do maintenance on the Discovery
- Know the emergency medical center number for your area
- Contact your nearest Lely service provider if you have any questions
- Review safety related items with all operators frequently (annually).

2.3.2 Electrical Safety

- Only an authorized electrician must install the electrical power supply for the charging station of the Discovery.
- Make sure the electrical grounding of the electrical system and all parts of the charging station of the Discovery meet the local rules and regulations.
- Replace any damaged electrical lines, conduits, switches and components immediately .
- Switch the power OFF with the OFF button on the ADS 3840 PCB before you start to work on the system (page 5-1).
- Pull the plug from the socket before you start to work on the charging station.

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2.3.3 Operating Safety

Remote Operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.

- Read and understand this manual and all safety signs before you connect power supplies to operate, maintain or adjust the Discovery
- Only trained persons are permitted to operate the Discovery
- Make sure all covers are installed before you operate the Discovery
- Keep hands, feet, hair and clothing away from all moving parts
- Keep away from all areas with high voltage
- Keep unauthorized persons, especially small children away from the Discovery at all times
- Always be alert for unexpected movement of the cow. Cows can transmit large forces to parts of the machine
- Contact your nearest Lely service provider if you have any questions
- Review safety related items with all operators frequently (annually).
- Make sure the slope of the floor is 6 degrees maximum (10,5 cm per 100 cm).

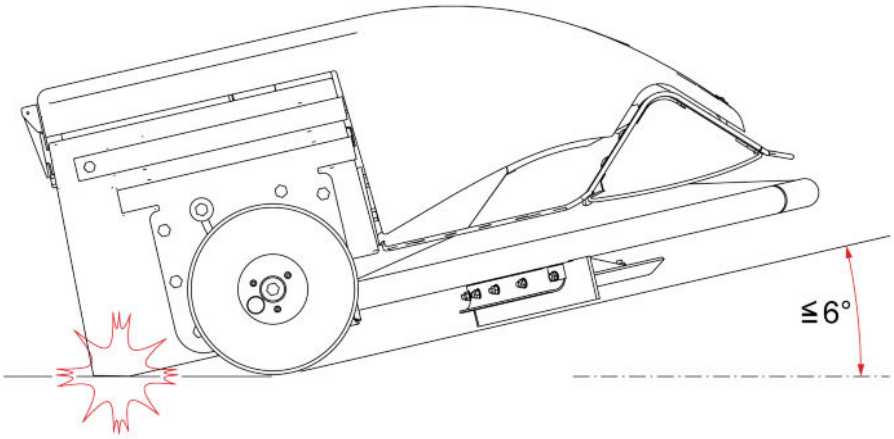

Figure 2. Maximum slope

2.3.4 Maintenance Safety

- Read and understand this manual and all safety signs before you connect power supplies to operate, maintain or adjust the Discovery
- Only trained persons are permitted to do corrective maintenance on the Discovery
- Disconnect and isolate the electrical power supply to the charging station before you do maintenance on it
- Switch OFF all timed actions before you do maintenance on the Discovery or clean it
- Do NOT touch the motors until they are cooled down

- Keep tools and metal parts away from the battery
- Do NOT use water to clean the body of the Discovery
- Use water and a brush to clean the manure scraper or the ultrasonic sensor of the Discovery. Refer to the maintenance instructions (page 6-6)
- Install all covers after you finished the maintenance.

2.4 Safety Decals

2.4.1 Safety Decal Messages

General safety messages appear in this safety messages section. Specific safety messages are in applicable parts of this manual when potential hazards may occur if the instructions or procedures are not followed.

Rotating Parts - Entanglement Hazard Symbol

Danger of being entangled by rotating parts.
Keep hands, loose clothing, and long hair away from moving parts during operation of the Discovery.

The 'Danger of being entangled by rotating parts' decal is located at the inner side of the motor plate of the Discovery.

2.4.2 Maintenance of Safety Decals

Safety decals on the Discovery Mobile Barn Cleaner 90 SW display important and useful information that will help you safely operate and maintain the Discovery.

Obey the instructions below to make sure all the decals stay in the correct position and condition.

- Keep the safety decals clean and legible at all times. Clean the safety decals with soap and water. Do not use mineral spirits, abrasive cleaners or other similar agents that may damage the safety decals
- Replace safety decals that are missing or are illegible
- Safety decals can be purchased from your local Lely service provider.

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2.4.3 Installation of Safety Decals

1. Make sure the installation surface is clean and dry.
2. Make sure the temperature of the mounting surface is not less than 5 °C (41 °F).
3. Identify the correct position for the decal before you remove the backing paper.
4. Remove a small part of the backing paper.
5. Put the decal in the correct position on the mounting surface and carefully press the small part of exposed adhesive surface of the decal onto the mounting surface.
6. Slowly remove the backing paper and attach the rest of the decal to the mounting surface.
7. Puncture small air pockets in the decal with a pin and use the backing paper to smooth the decal.

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3. SPECIFICATIONS

3.1 Barn Cleaner

3.1.1 Dimensions and Weight

Refer to the Diagrams chapter for the complete dimensions of the Discovery.

- Length: 1362 mm (53.60 in)
- Width: 860 mm (33.86 in)
- Height: 575 mm (22.64 in)
- Weight: 340 kg (750 lb)
- Sensing ring height: 102 mm (4.02 in).

3.1.2 Battery

- Number of batteries: 1
- Nominal voltage: 12 V
- Capacity: 55 Ah
- Charging time: 6 hours maximum
- Spare capacity: 120 min

3.1.3 Operation

- Number of different programmable routes: max 16
- Number of actions per route: max 125
- Number of routes per time path: max 48
- Maximum duration of a time path: 24 hour
- Travel speed: 10.8 to 18 m/min (display: 180 - 300 mm/sec.)
- Maximum driving time without charging: 4 hours

3.1.4 Cleaning Capacity

- Max. cleaning capacity: 918 m²/h at 18 m/min

3.1.5 Miscellaneous

- Suited for all level slatted floors
- Drive: 2 electric motors
- Average power consumption: 0.05 kWh
- Number of wheels: 2 drive wheels
- Detection of the driving direction: gyroscope
- Distance measurement to wall: ultrasonic sensor
- Traveled distance: measured via encoders on the motors
- Water tank capacity: 30 l (7.9 gal)
- Water output 2 nozzles: approx. 1 l/min (0.26 gal/min).

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3.2 Charging Station

3.2.1 Dimensions and Weight

Charging station

- Width: 380 mm (15.0 in)
- Depth: 220 mm (8.7 in)
- Height: 1650 - 2050 mm (65.0 - 80.7 in)
- Weight (excluding floor column): 40 kg (88 lbs)

Floor column (optional)

- Width: 370 mm (14.6 in)
- Depth: 100 mm (3.9 in)
- Height: 2100 mm (82.7 in)
- Weight: 44 kg (97 lbs)

3.2.2 Battery Charger

- Type: Impulse "L"
- Input voltage: 230 VAC (50 Hz) or 110 VAC (60 Hz)
- Nominal output voltage: 12 VDC
- Max. charge current: 20 A
- Max. power: 430 W
- Weight: 1.7 kg (3.7 lbs)
- Length, excluding battery terminals: 196 mm (7.7 in)
- Width: 150 mm (5.9 in)
- Height: 68 mm (2.7 in).

3.3 Water Filling Station

3.3.1 Dimensions and Weight

Refer to the Diagrams chapter for the complete dimensions of the Discovery.

- Width: 406 mm (16.0 in)
- Height: 282 mm (11.1 in)
- Depth: 231 mm (9.1 in)
- Weight: 11 kg (24.3 lb)

3.3.2 Water Requirements

- Max. water inlet pressure water filling station: 2.5 bar (36 psi).
- Use potable water to prevent blockage of the nozzles or the water pump.

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3.4 Header Tank (Optional)

3.4.1 Dimensions and Weight

Refer to the Diagrams chapter for the complete dimensions of the Discovery.

- Width: 400 mm (15.7 in)
- Height: 300 mm (11.8 in)
- Depth: 200 mm (7.9 in)
- Weight: 6 kg (13.2 lb); completely filled: 14 kg (31 lb).

3.4.2 Hygiene Protection

The header tank meets the standard "NEN-EN 1717:2000 en" which deals with the means to be used to prevent the pollution of potable water inside premises and the general requirements of protection devices to avoid pollution by backflow.

3.5 Requirements Smartphone

Use of a tablet is technically possible if it meets the specifications. However, the user interface might not be displayed optimally since it is designed for smartphones.

- Screen resolution 480 x 800 (or higher).
- Android 2.3.x, 4.0.x or 4.2.x.
- Bluetooth version 2.0, 2.1, 3.0, 4.0 dual mode (4.0 single mode is not supported) .
- Compliance with 1999/5/EC european directive for Radio and Telecommunications Terminal Equipment.
- For software updates a WiFi or 3G network must be available.
- Processor: 1 GHz (or higher).
- Android smartphone must have at least 10 MB free storage.

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4. DESCRIPTION AND OPERATION

4.1 Introduction

This chapter describes the parts of the Discovery. It also explains how the parts work together to clean the barn floor.

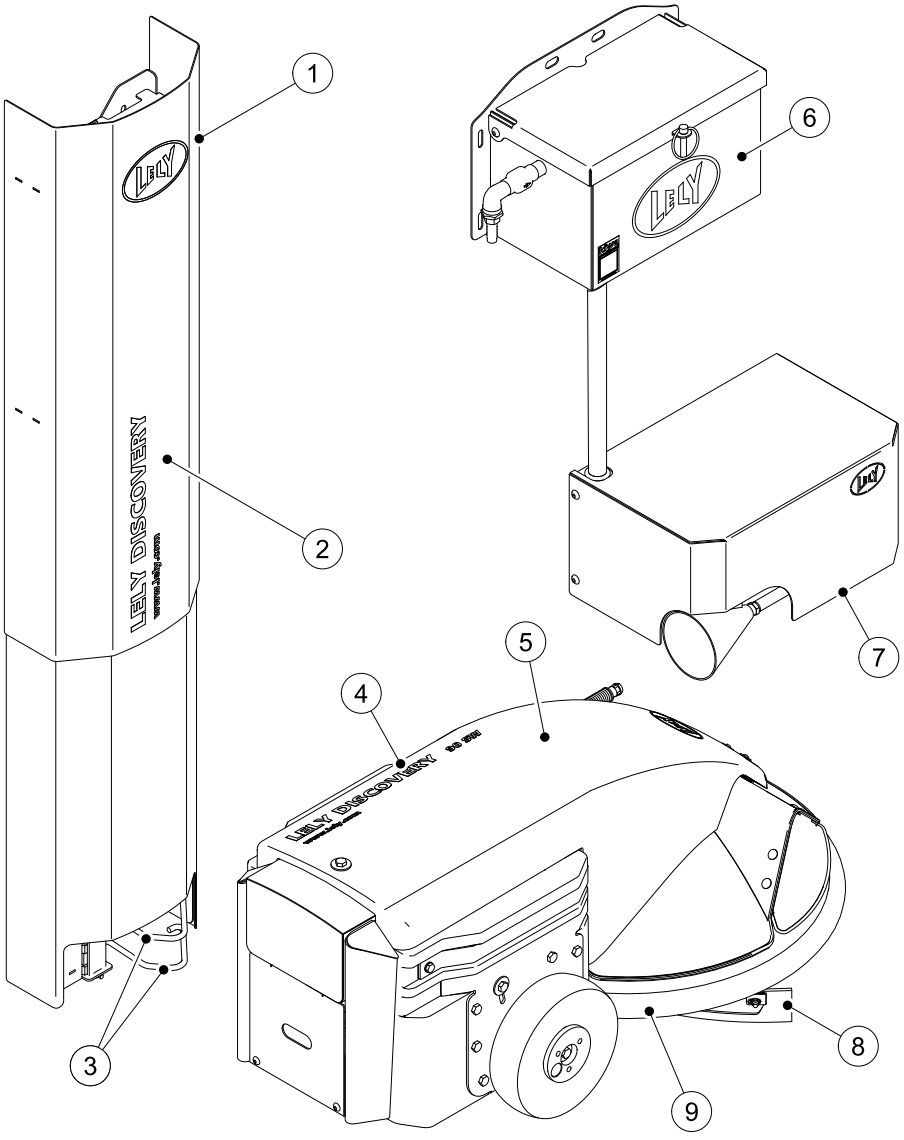

Figure 3. Main components

KEY:
1. Indicator LEDs (not visible) - 2. Charging station - 3. Charging electrodes - 4. Discovery vehicle - 5. Upper cover - 6. Header tank (optional) - 7. Water filling station - 8. Manure scraper - 9. Sensing wheel

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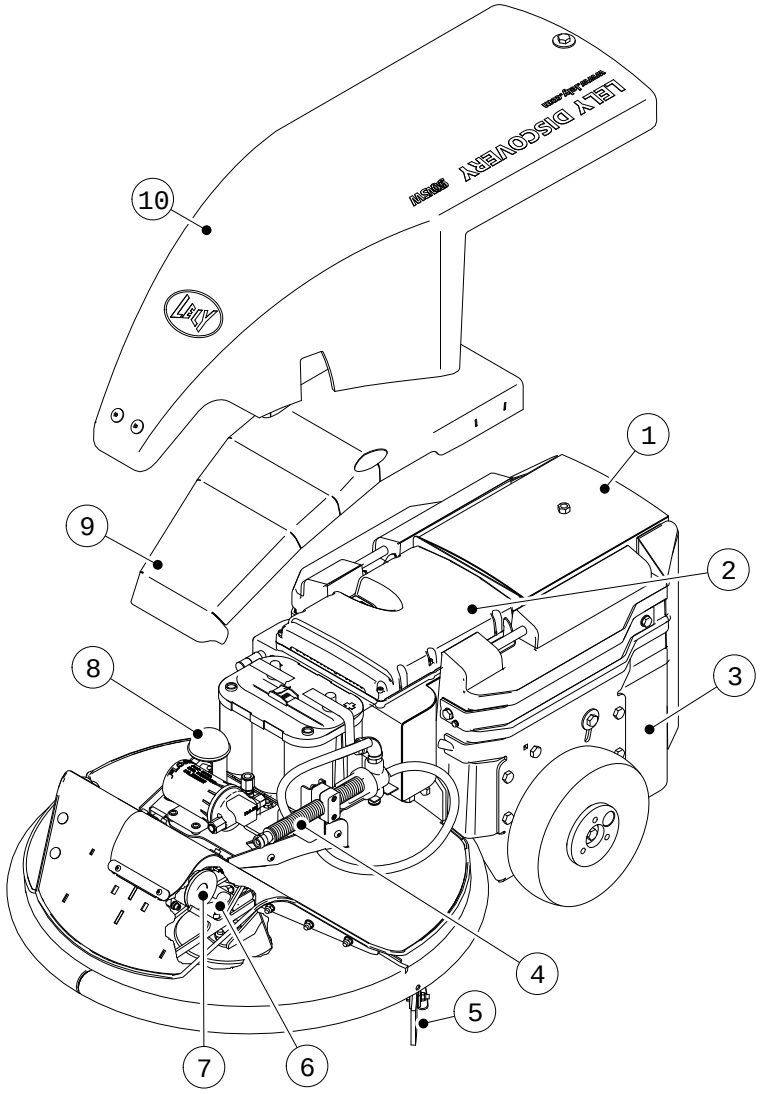

Figure 4. Main components Discovery Mobile Barn Cleaner 90 SW Vehicle

KEY:
1. Water tank - 2. PCB box - 3. Concrete block/frame - 4. Water inlet - 5. Manure scraper - 6. Water sprayer (1 of 2) - 7. Ultrasonic sensor - 8. Bluetooth antenna 9. Lower cover - 10. Upper cover

4.2 Component Description

4.2.1 Discovery Mobile Barn Cleaner 90 SW Vehicle

The Discovery has the following mechanisms and systems:

- Cleaning mechanism
- Driving mechanism
- Power system
- Control system.

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4.2.1.1 Covers

The Discovery has a red upper cover with a bolt to fasten it on the back side. At the front side of the vehicle a rotatable bracket holds the cover. Underneath the red upper cover, the lower cover gives extra protection to the main components (page 4-2) of the Discovery.

4.2.1.2 Cleaning System

A manure scraper installed underneath the Discovery pushes the manure through the openings of the slatted floor (page 4-2).

4.2.1.3 Driving Mechanism

The driving mechanism has the following parts:

- Two drive motors
- Two chains
- Two chain wheels
- Two wheels.

The motors, one on the left side and one on the right side, drive the wheels via chains.

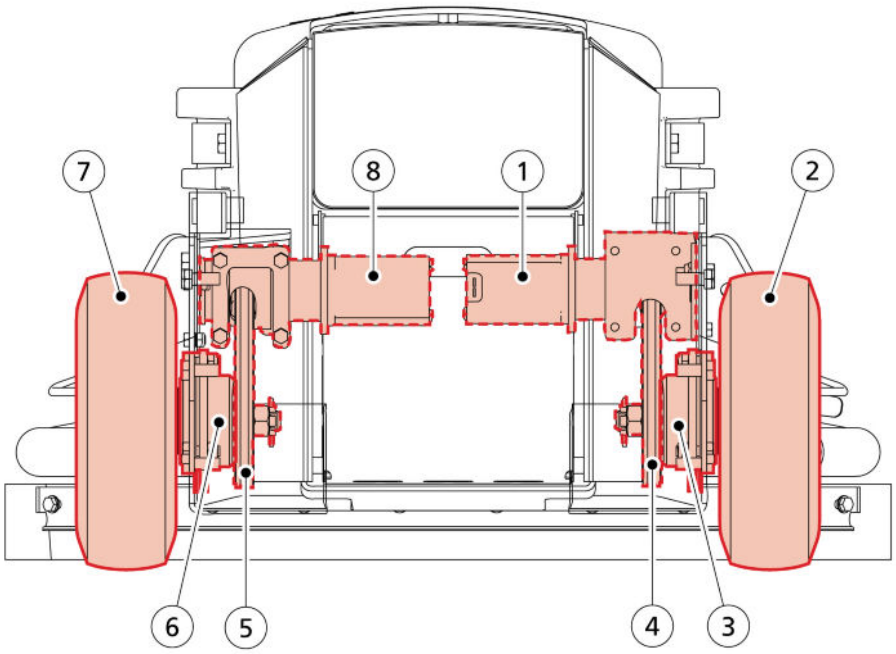

Figure 5. Driving mechanism

KEY:
1. Motor right - 2. Wheel right - 3. Wheel bearing- 4. Chain right - 5. Chain left - 6. Wheel bearing - 7. Wheel left - 8. Motor left

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4.2.1.4 Water Supply System

Two nozzles on the front spray water on the manure to soften the manure. The water supply system supplies water to the nozzles. The water supply system has:

- Water inlet
- Water filter
- Water tank
- Pump, pumps the water from the water tank to the nozzles. Switched ON only during a route.
- Two nozzles.

The water tank is balanced installed on the concrete block and has a capacity of 30 liter, enough for one route.

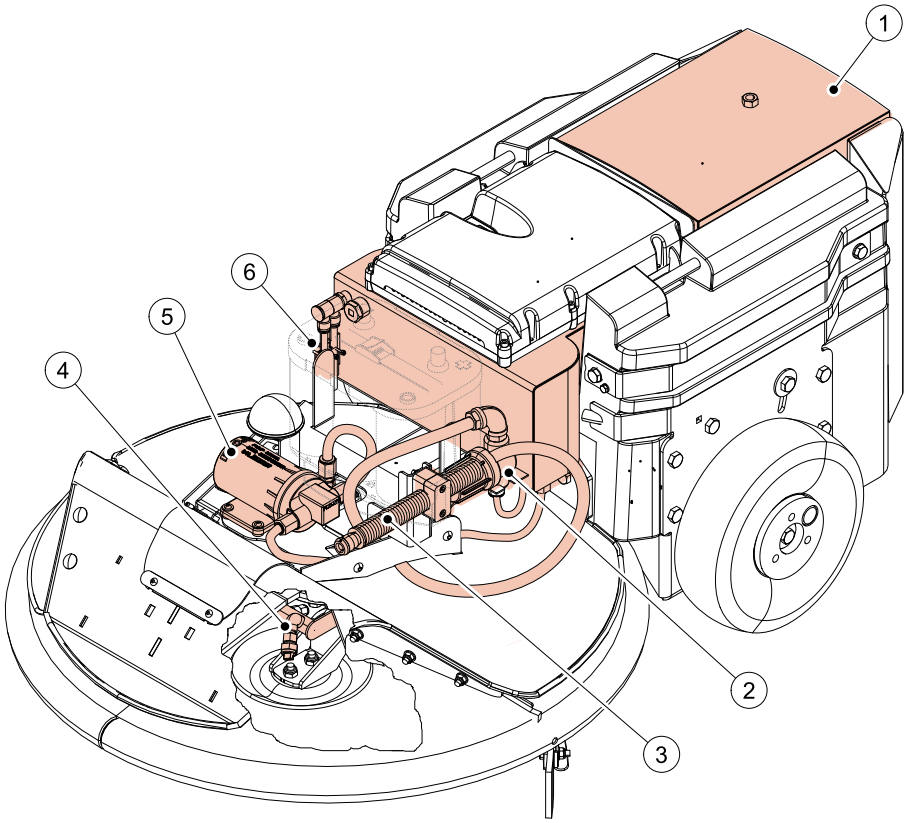

Figure 6. Water supply

KEY:
1. Water tank - 2. Water filter - 3. Water inlet- 4. Water sprayer (1 of 2) - 5. Water pump - 6. Water sensor

4.2.1.5 Power System

The Discovery is battery-operated and after each route it returns to the charging station, which is installed at a convenient point in the barn. This charging station also functions as the starting point of each route.

The power system stores and distributes the electrical power for the driving mechanism and the ADS 3840 PCB. The power supply is a single

rechargeable 12V traction battery. Charging takes place at the charging station. The power system has the following primary parts:

- Battery
- Charging strips
- ON/OFF switch
- ADS 3840 PCB.

4.2.1.6 Control System

The control system has the following parts:

- ADS 3840 PCB, to control the operation of the Discovery
- Encoders on the drive motors to measure the driven distance
- Ultrasonic sensor to measure the distance to wall or fence
- Gyroscope to measure angle differences to keep the right direction.

The water sensor detects when the water tank is full. The water temperature sensor measures the water temperature for frost protection.

Encoders

Each drive motor has an encoder that counts the rotation of the motor shaft. This information is used to calculate the position of the vehicle.

The encoders send outputs to the ADS 3840 PCB.

Ultrasonic Sensor

The ultrasonic sensor makes sure the Discovery follows the wall or fence at a pre-determined distance.

A foam ring is adhered on the sensor to minimize reflections and to focus the reflected beam.

The sensor gets inputs from and sends outputs to the ADS 3840 PCB.

Gyroscope

The gyroscope measures the turning angle. This information is used to find the correct direction. The gyroscope is essential for driving a route when there is no wall that can be followed.

The gyroscope (1) is combined with the ADS 3840 PCB.

The gyroscope is not a spare part.

Water Sensor

The water sensor is installed next to the air release tube and detects when the tank is completely filled.

Pause button

A pause button is installed on the Discovery. When the pause button is pushed while the Discovery is in operation, the Discovery goes into pause mode:

- The Discovery stops.
- The LED light in the pause button turns on.
- The operational sound of the Discovery is turned off.
- The user interface on the smartphone displays a question to resume or cancel the route.

When the pause button or the button in the Lely Control app is pushed shortly while the Discovery is in pause mode, the Discovery goes back into work mode:

- The Discovery goes back into operation.
- The LED light in the pause button turns off.
- The operational sound of the Discovery is turned on.

The pause button can be operated remotely with the Lely Control app on the smartphone.

If an alarm occurs, the LED in the pause button blinks. The alarm must be confirmed with the Lely Control app on the smartphone.

Status of the Discovery	LED status of the pause button
Start up	Blink
Out of operation. Lely Control app in main tab menu Work	On
Out of operation. Lely Control app in other menu	Blink
Discovery paused	On
Discovery in normal operation	Off
Alarm	Blink

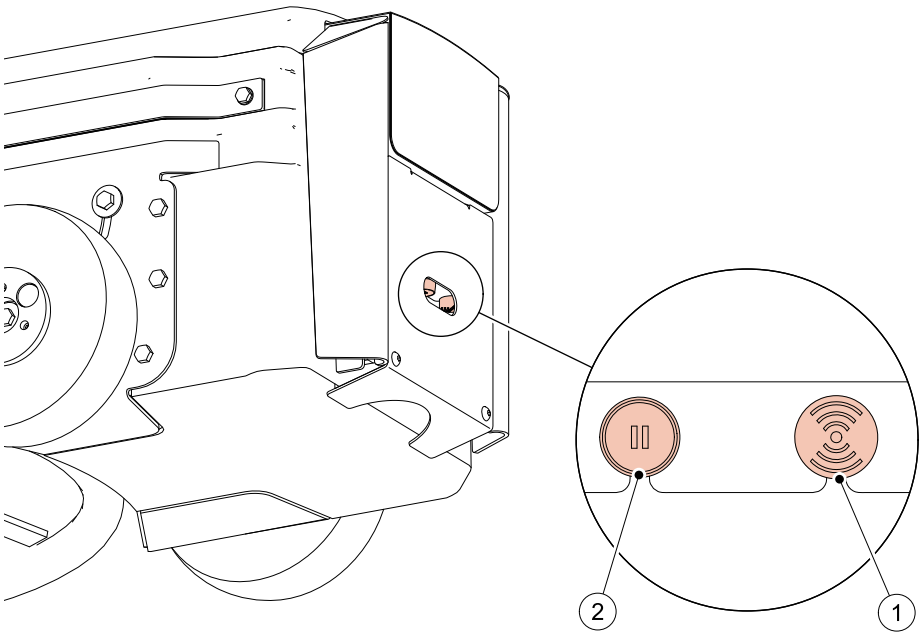

Figure 7. Pause button and acoustic warning device

KEY:
1. Acoustic warning device - 2. Pause button

Acoustic Warning Device

An acoustic warning device alerts persons and cows when the vehicle starts to move, moves or when an alarm occurs.

The beep lengths and beep frequencies of the acoustic warning device are:

Operational state of the Discovery	Beep frequency acoustic warning device
Normal operation	Once per 2 seconds (default)
An alarm occurred	3 short beeps every minute

The acoustic warning device is installed on the Discovery.

Lely Control app

The Lely Control app controls and monitors the Discovery and communicates with the management software. The Lely Control app is available in the Google play store (Android).

The user interface of the Lely Control app displays nine buttons that enable the user to give commands and change values in the Discovery. The user interface also shows reports and alarms.

The Lely Control app communicates via bluetooth with the software on the ADS 3840 PCB.

The user interface has the following buttons:

- [ ] Execute the command on the display above the applicable soft button.
- [**START/STOP**] starts or stops an action.
- [△] moves the selector up one item or increases a value by one.
- [▽] moves the selector down one item or decreases a value by one.
- ↵ opens the selected function or the next menu screen.
- [ESC] returns to the previous screen.
- reduces the speed of the vehicle.

Acoustic signal

The Lely Control app gives an acoustic signal when:

- The Discovery is in normal operation
- Settings are saved
- The calibration of the gyroscope is finished
- Backup is finished (create / restore)
- Programming a route

4.2.2 Charging Station

The Discovery normally starts and ends at the charging station. The Discovery recharges itself at the charging station. The battery charger electrodes are at the front near the bottom of the charging station.

The Discovery can be left permanently connected to the charging station. This keeps the battery in good condition. The ADS3840 PCB continuously examines the voltage of the battery. It is not possible to overcharge the battery.

The charging station has a 20 A electronic battery charger.

The charging station can be installed in the barn in two ways:

- wall-mounted
- floor-mounted.

If it is not possible to install the charging station to the wall, an optional floor column can be supplied.

Battery Charger

The 20 A electronic battery charger has two indicator LEDs on the upper right side. The LEDs are visible through the opening in the red cover. The meaning of the LEDs are:

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Status	Charging LED (orange)	Power LED (green)
Mains connected	OFF	ON
Recharging (>1A)	ON	ON
Error	blinking	blinking

4.2.3 Water Filling Station

The Discovery refills itself at the water filling station (page 4-1) (7). The water filling station has:

- Mechanically operated shut-off valve
- Water outlet

When the water filling station is connected to the drinking water system, a header tank must be installed between the drinking water system and the water filling station to prevent the pollution of potable water by backflow of water with bacterial contamination (page 3-3).

The header tank supplies water with a constant pressure (0.2 bar) to the water filling station. The water station is installed next to the charging station on the wall. The header tank is installed 2 m above the floor.

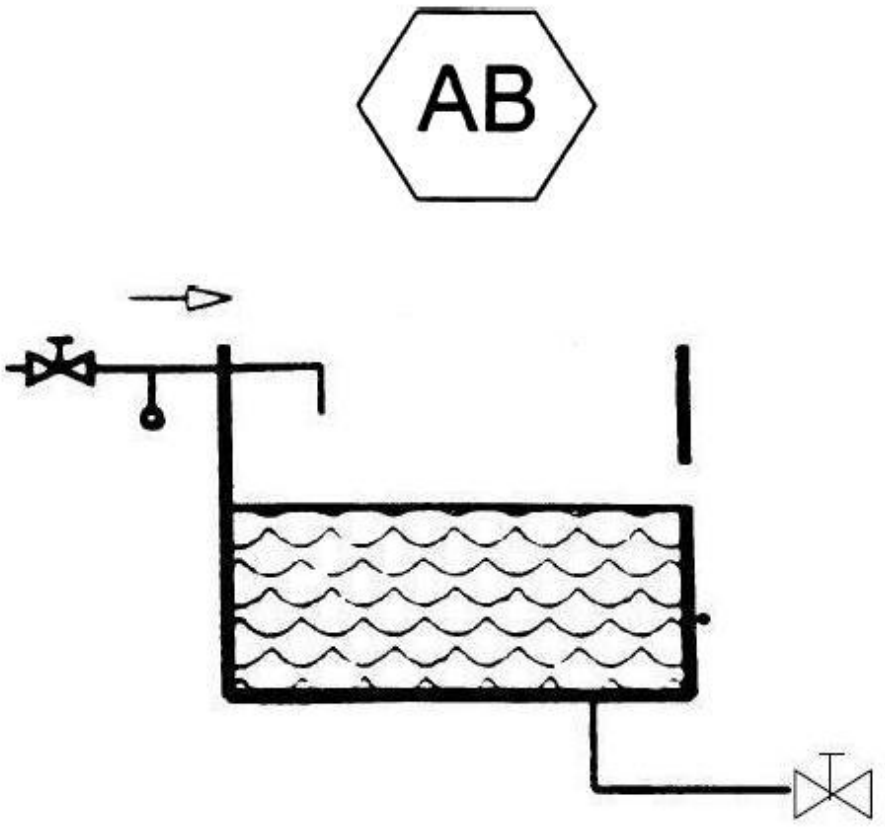


Figure 8. Symbolic representation of the header tank

4.3 User Interface

The Discovery is operated with a smartphone with an Android operating system. The smartphone communicates with the software via bluetooth. The main menu on the smart phone has the following items:

- Work
- Routes
- Test
- Settings
- Alarms
- Service.

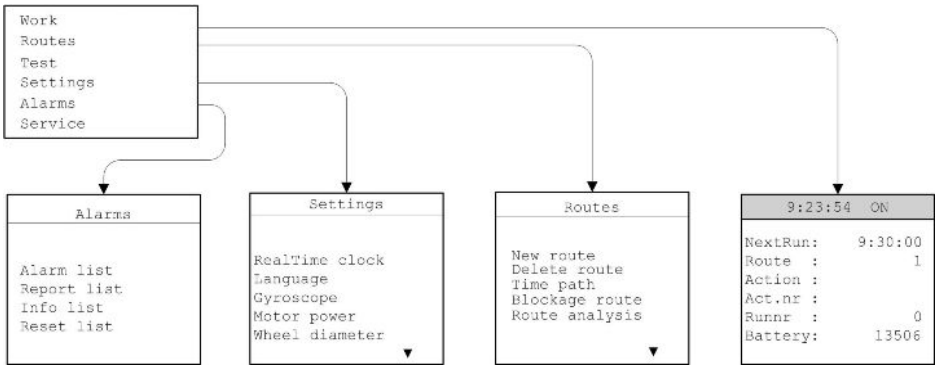


Figure 9. The Lely Control app menu structure

Buttons:

- [△] or [▽] to select a menu item
- [↵] to confirm an action
- [ESC] to go to the previous menu.

4.3.1 Work

The menu 'Work' is used for daily operation of the Discovery. You can operate the Discovery in automatic mode using a time path and in manual mode.

The menu 'Work' has the following submenu's:

- ON /OFF (to switch the time path ON or OFF)
- MANUAL ROUTE (to manually start a selected route)
- MANUAL DRIVING (to manually drive the Discovery)
- MANUAL CHARGER (to drive the Discovery to the charging station, following the wall).

The button [↵] must be used to open next menu, [ESC] to open the previous menu. A black dot on the right side of the screen indicates the level. The highest level (ON/OFF) has for instance a dot on the upper side, the lowest level (MANUAL CHARGER) a dot on the lower side.

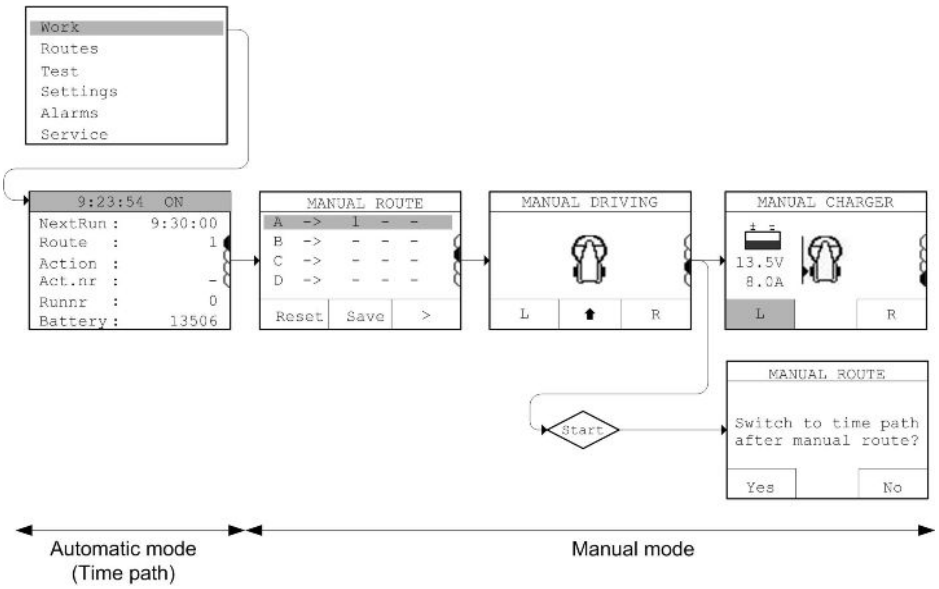


Figure 10. Menu Work

The level is indicated by a tab with a black dot on the right side of a display. There are four levels:

- Menu 'Work', indicated by the upper dot
- 'Manual route', indicated by the second dot
- 'MANUAL DRIVING', indicated by the third dot
- 'MANUAL CHARGER', indicated by the fourth dot.

4.3.1.1 Time Path ON/OFF

If the time path is switched ON, the upper pane is grayed out (see the following figure).

Display	Description
9:23:54 ON NextRun: 9:30:00 Route : 1 Action : Act.nr : - Runnr : 0 Battery: 13506	• Start or stop timed actions which are set in a time path (page 4-19) • Display the status: - Actual time - ON or OFF - NextRun: start of the next route - Route: route number - Action: action description (visible during route) - Act.nr: sequence number for the action in this route - Runnr: run number - Battery: battery voltage.
9:23:54 OFF NextRun: 9:30:00 Route : 1 Action : Act.nr : - Runnr : 0 Battery: 13506	

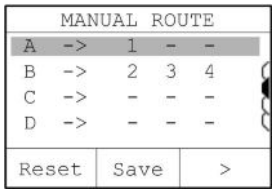
Buttons:

- [**START/STOP**] to start or stop timed actions
- [↵] to go to the next menu
- [ESC] to go to the previous menu. Or

Push the pause button (page 4-6) on the Discovery to start or stop timed actions.

4.3.1.2 Manual Route

Driving manual route is only possible when the time path is switched OFF.

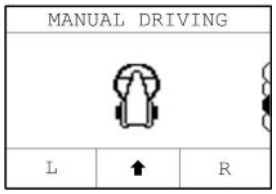
Display	Description
	• Let the vehicle drive a series of maximum 3 subsequent routes

Buttons:

- [**START/STOP**] to start or stop the action
- [ESC] to go to the previous menu
- [↵] to go to the next menu
- Soft button [>] to select the first, second or third route in the series
- Button [△] or [▽] to select the route number
- Soft button [**Reset**] to clear the set route(s)
- Soft button [**Save**] to save the set route. [⬆]

4.3.1.3 Manual Driving

Driving manual route is only possible when the time path is switched OFF.

Display	Description
	• Move the vehicle manually (page 5-3)

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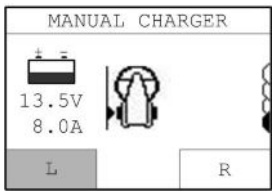
Buttons:

- [**START/STOP**] to start or stop the action
- [↵] to go to the next menu
- [ESC] to go to the previous menu
- Soft button [L] to turn right
- Soft button [R] to turn left
- [↑] to select the drive direction.

4.3.1.4 Manual Charger

Driving manually to the charger is only possible when the time path is switched OFF.

Display	Description
	• Let the vehicle automatically drive to the charging station, following the wall (starting within 1 m from the charging station) (page 5-4) • The values on the display indicate the battery voltage and the charge current.

Buttons:

- [**START/STOP**] to start or stop the action
- [↵] to go to the next menu
- [ESC] to go to the previous menu
- Soft buttons [L] and [R] to select the position of the charging station.

4.3.2 Routes

The menu 'Routes' is used for programming routes or for test and adjustments.

Buttons:

- [△] or [▽] to select a menu item
- [↵] to confirm an action
- [ESC] to go to the previous menu.

4.3.2.1 New Route

A new route is built from the following actions:

- 'Water filling'
- 'Wall flw L' or 'Wall flw R'
- 'Straight'

- 'Turn L <--' or 'Turn R -->'
- 'Ultrasound L' (or 'Ultrasound R' or 'Ultrasound L+R')
- 'Charger'
- 'Waiting time'.

A route has a maximum of 125 actions.

Water filling

Drive from the charging station to the water filling station. After water filling the Discovery drives back (adjustable) before it is ready for the next action.

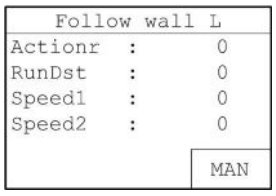
The display shows the following information:

Display	Description
	• Actionr: sequence number for the action in this route • Back: the distance the Discovery drives back after filling (default 0.5 m (19 in))

Wall Follow L

Tracking along a wall on the left. The motor on the left side runs at 99% and the right motor runs at 100%. The sensing wheel is pushed to the wall.

The display shows the following information:

Display	Description
	• Actionr: sequence number for the action in this route • RunDst:distance travelled in mm • Speed1: left wheel speed in mm/s • Speed2: right wheel speed in mm/s

Buttons:

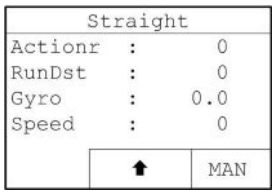
- [**START/STOP**] to start or stop
- [ ] to reduce speed when approaching a bump point
- Soft button [MAN] to adjust the position of the vehicle to get a good start position (direction).

The same description applies for following a wall on the right side.

Straight

Drive straight forward, only with the use of the gyroscope to correct the position.

The display shows the following information:

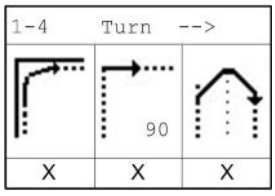
Display	Description
	• Actionr: Sequence number for the action in this route • RunDst:Distance traveled in mm • Gyro: Angle value in gyroscope • Speed: Wheel speed in mm/s.

Buttons:

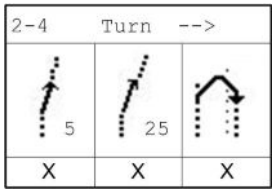
- [**START/STOP**] to start or stop
- [ ] to reduce speed when approaching a bump point
- Soft button [MAN] to adjust the position of the vehicle to get a good start position (direction)
- Soft button [⬆] to change the direction.

Turn --> or <-- Turn

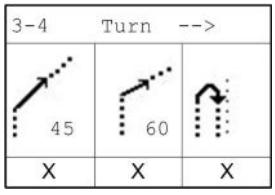
Turn right or left. You can choose from 12 standard turns to both right and left. The chosen turn can be adjusted according to the specific situation. The standard curves are:



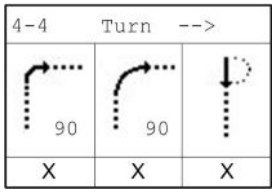
- Turn right 60 degrees gradually, following wall, maximum cleaning
- Turn right 90 degrees
- Turn right 180 degrees, stop in adjacent lane 80 cm (31 in.) to the right.



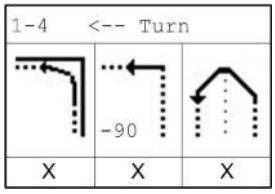
- Turn right 5 degrees
- Turn right 25 degrees
- Turn right 180 degrees, stop in adjacent lane 40 cm (16 in.) to the right (clean 50 cm (20 in.) from previous lane).



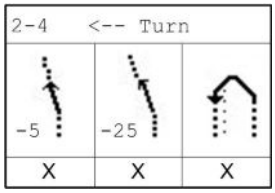
- Turn right 45 degrees
- Turn right 60 degrees
- Turn right 180 degrees, stop in the adjacent lane 20 cm (8 in.) to the right (clean 70 cm (28 in) from the previous lane).



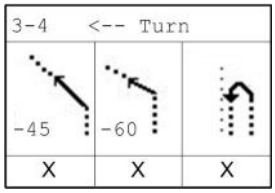
- Make a sharp right turn, maximum cleaning in the corner
- Turn right 90 degrees
- Turn right 180 degrees.



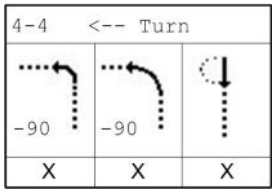
- Turn left 60 degrees gradually, following wall, maximum cleaning
- Turn left 90 degrees
- Turn left 180 degrees, stop in adjacent lane 80 cm (31 in.) to the left.



- Turn left 5 degrees
- Turn left 25 degrees
- Turn left 180 degrees, stop in adjacent lane 40 cm (16 in) to the left (clean 50 cm (20 in.) from previous lane).

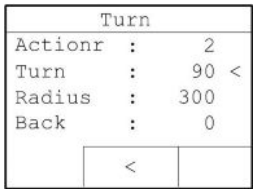


- Turn left 90 degrees, no wall following
- Turn 180 degrees
- Turn left 180 degrees, stop in adjacent lane 20 cm (8 in) to the left (clean 70 cm (28 in) from the previous lane).



- Make a sharp left turn, maximum cleaning in the corner
- Turn left 90 degrees
- Turn left 180 degrees.

After selecting an option, the variables of the turn can be adjusted. The display shows the following information:

Display	Description
	• Actionr: Sequence number for the action in this route • TurnAngle of the turn, positive value (+) = turn right, negative value (-) = turn left • Radius: The radius of the turn the vehicle will make: 0 = on the spot, 300 = about one of the drive wheels For instance: a turn of 180 degrees with a radius of 0 is used to clean the same lane again. A turn of 180 degrees with a radius of 300 is used to clean the next lane. • Back: The distance (in mm.) the vehicle first goes back before making the turn (**needed if the vehicle is near an obstacle**).

Buttons:

- Soft button [**<**] to select the variable you want to modify
- Push [△] or [▽] to adjust the value of the selected variable
- [**START/STOP**] to start or stop
- Soft button [MAN] to adjust the position of the vehicle.

The same description applies for turning to the left.

Ultrasound L

Tracking along a wall or fence on the left at a certain distance (max. 200 cm (6.5 ft)). The ultrasonic sensor is used to measure the distance to the wall (page 4-5).

Default the ultrasonic sensor is installed on the left. If the sensor is installed on the right, the menu is 'Ultrasound R' or if a sensor is installed on both sides, the menu is 'Ultrasound L+R'.

The display shows the following information:

Display	Description
Ultrasound L Actionr : 3 RunDst : 0 UltraDst: 856 ULTRADST: 1100 < MAN	• Actionr: Sequence number for the action in this route • RunDst: Covered distance (mm) • UltraDst: Actual distance to the wall (mm) (max. 200 cm (6.5 ft) • ULTRADST: Adjustable distance to the wall (mm).

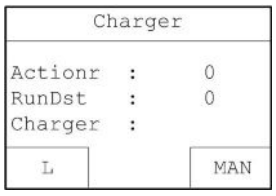
Buttons:

- [△] or [▽] to modify the value of the selected variable
- [**START/STOP**] to start or stop
- Soft button [MAN] to adjust the position of the vehicle.

Charger

Drive the vehicle back to the charging station. The Discovery finds the charging station independently (default = on the left), within a distance of 1.5 - 3 m (5 -10 ft.) (page 5-21). The vehicles nose must point approximately into the direction of the charging station.

The display shows the following information:

Display	Description
	• Actionr: sequence number for the action in this route • RunDst:Covered distance (mm) • Charger: not applicable

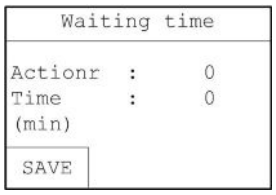
Buttons:

- Soft button [**L**] to modify the position of the charging station
- Soft button [MAN] to adjust the position of the vehicle
- [**START/STOP**] to start or stop.

Waiting time

Wait an adjustable time before continuing with the next action in a route (page 5-21). This action is used in a route through a waiting area. The vehicle stops before entering the area to give cows time to move out.

The display shows the following information:

Display	Description
	• Actionr: Sequence number for the action in this route • time (min): Waiting time (min).

Buttons:

- [△] or [▽] to modify the value of the selected variable
- [**START/STOP**] to start or stop

Soft button [Save] to save the setting.Buttons:

- [△] or [▽] to modify the value of the selected variable
- [**START/STOP**] to start or stop

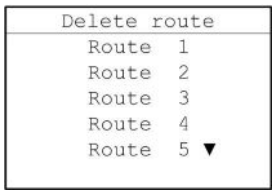
Soft button [Save] to save the setting.Buttons:

- [△] or [▽] to modify the value of the selected variable
- [**START/STOP**] to start or stop
- Soft button [Save] to save the setting.

4.3.2.2 Delete Route

This menu is used to delete an existing route.

The display shows the following information:

Display	Description
	• List of set routes.

Buttons:

- [△] or [▽] to select a route
- [↵] to confirm.

4.3.2.3 Time Path

It is useful to combine routes into a time path. If the time path is switched ON the Discovery drives the set routes automatically at the set times each day. A time path lasts maximum 24 hours. A time path has 48 time/route combinations maximum, made up of 16 different routes maximum.

The display shows the following information:

Display	Description
	• Time path; start times of set routes.

Buttons:

- [△] or [▽] to select a route in the time path
- Soft button [Del] to delete a route from the time path
- Soft button [New] to add a new route to the time path
- Soft button [**>**] to select the next variable.

4.3.2.4 Blockage Route

This menu is used to temporary block one or more routes. If you do not want the vehicle to drive in a particular part of the barn, block the routes that go through that part. Blocked routes will be skipped from the time path.

This option can be used if part of the barn is reconstructed or if a cow is calving.

4.3.2.5 Route Analysis

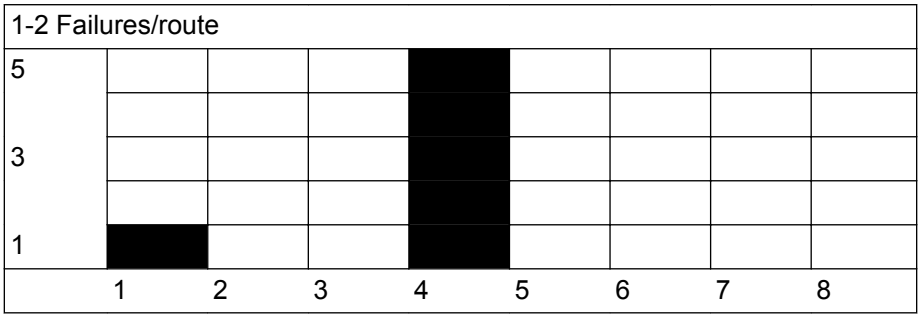
The menu 'Route analysis' has the following options:

- 'Fail. problty'
- 'Failure analys'.

'Fail. problty' gives a quick overview of the reliability per route. 'Failure analys' gives detailed information and shows per route the action numbers have a high risk of failure. It also gives an indication of the fault (page 7-3).

Failure Probability per Route

The display 'Fail. problty' displays for each route, numbered from 1 - 16, the probability of a failure on a scale from 0 - 5. In the next figure route 1 has a low risk and route 4 a very high risk.



If a routes has a failure probability of more than 2, the risk of failures is too high. This could be due to a number of factors like:

- few bump points
- many so called 'short actions', like 'Straight', ' Turn L <--' or 'Turn R -->' without 'long actions' in between to enable the Discovery to correct itself
- obstacles.

Buttons:

- [↵] to open the next screen
- [**ESC**] to go one level up.

Failure Analysis

The display Failure analysis has 3 tables:

- The table Failure analysis displays per fault category (A - H) the action numbers that causes a risk
- The second table displays the percentage of actions in a route that have bump points (must be more than 20%) and the percentage short actions versus long actions (must be less than 50%)
- The third table displays explanations.

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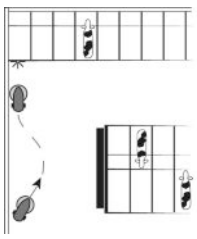
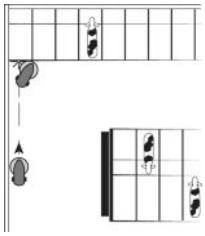
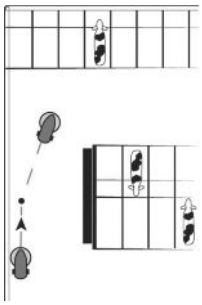
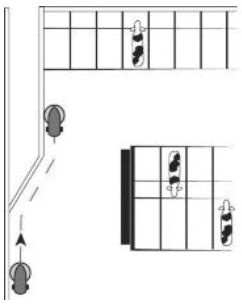
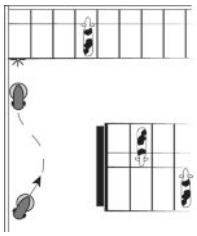
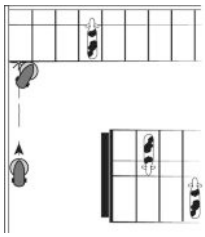
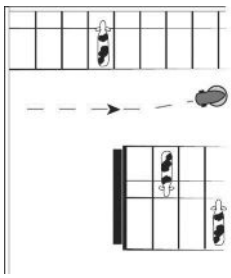
	Display text	Explanation	
A	Bends in route	Very unreliable route due to a combination of factors (B-H)	
B	Start-Resetp. angle	Angle of more than 20 degrees between the start and the reset point. This could be due to an angled start point	
C	Resetp.-End angle	Angle of more than 15 degrees between the reset point and the end point. The vehicle goes in the wrong direction before it reaches the end point. This could be due to an obstacle	
D	Angle betw. actions	Vehicle has unexpectedly turned after saving an action, causing the next action to start in a different direction.	
E	Drift/bend action	Vehicle is forced to make a bend during an action (wall follow or ultrasound drive) less than 1.5 m (4.9 ft.) after the start of the action.	

	Display text	Explanation	
F	Drift/angled start	Vehicle starts angled due to, for instance angled ending of the previous action	
G	Angled ending	Vehicle ends action angled (>10 degrees) due to for instance a collision with a cow leg	
H	Straight > 5 m	Deviation caused by driving straight for more than 5 m (15.4 ft)	

4.3.2.6 Speed Route

This menu is used to set the speed for a route (page 5-27).

The maximum speed is 300 mm/sec. which is approximately 18 m/min.

During programming, the speed is 300 mm/sec., during operation the speed is default 180 mm /sec. (10.8 m/min). You can adjust the speed for each particular route.

4.3.2.7 Speed Action

This menu is used to set the speed for an action during a route (page 5-27), for example driving slowly when passing the feed fence or a waiting area.

4.3.2.8 Beepfreq Route

This menu is used to set the beep frequency during the driving. The default frequency is every 2 seconds. The frequency can be set for each route separately. The display displays the value per second, so 0.5 equals one peep per two seconds. When the value is set to zero, the beep is switched OFF.

Switch the beep ON if the route passes a feed fence or a waiting area. The cows present in the area are alerted and can move out of the way.

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4.3.2.9 Copy Route

The menu 'Copy route' is used to copy a route. The copied route can be modified to make a new route.

4.3.2.10 Modify Route

The menu 'Modify route' is used to modify parts of an existing route. Since a route is built of many actions, changing one action influences the rest of the route. Therefore modification is restricted to:

- Modify the run distance
- Modify the angle of a turn
- Add waiting time.

Examples:

If the Discovery slips during action (3), the vehicle will not reach the wall during the next action (4). Instead of following the wall, it will then hit the manger on the cross wall. In that case the run distance of action 3 ('Straight') should be increased.

If, after following a wall, a crosswalk must be passed, the Discovery must first make a small turn to the left (2). Otherwise the vehicle will hit the cross wall on the other side of the crosswalk. If it turns out that, despite the turn, the vehicle hits the wall, the angle of the turn must be increased.

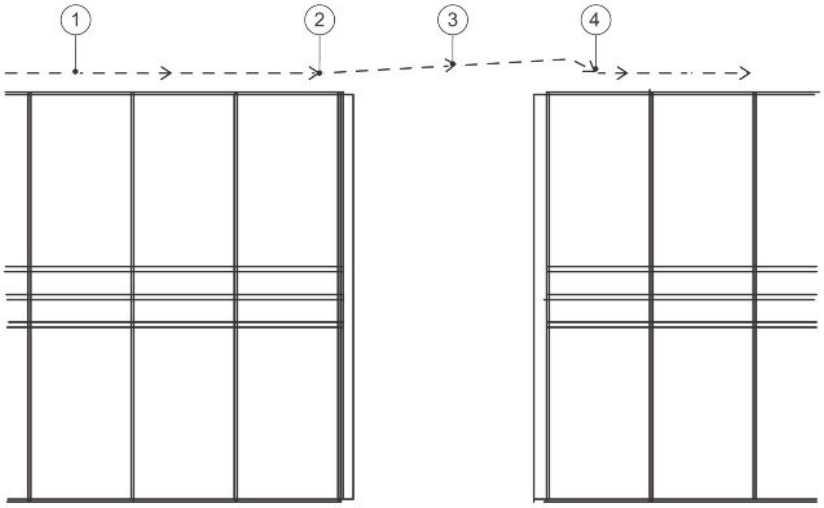

Figure 11. To pass a crosswalk

4.3.2.11 Wheel Correction

If the wheels become worn, the diameter and thus the covered distance per rotation decreases. As a result the driving distance in a route decreases.

The menu 'Wheel corr.' is used to correct the wheel diameter in the software and thus the driving distance.

4.3.2.12 Backup Route

This menu is used to make a backup with the Lely Control app on the smartphone or to restore the information on the ADS 3840 PCB.

4.3.2.13 Sprinkler Route

The menu 'Sprinkler route' is used to set the water sprinkler 'On' or 'Off' per route.

4.3.3 Test

The menu 'Test' is used to do functional tests of components and actions.

4.3.4 Settings

RealTime clock

This menu is used to set the date and time of the Discovery. The correct date setting is also important to search for alert reports on a date.

Date 02-09-12 (dd/mm/yy).

Time 16:53:31 (hh/mm/ss).

Language

This menu is used to modify the language of the user interface.

Gyroscope

This menu is used to recalibrate the gyroscope. The Discovery must not be moved during the calibration.

Motor power

The motor power must be high enough to overcome an unevenness or a slope. Otherwise it must not be too high, because the control system uses the current value to detect an obstacle.

The motor power can be set to:

- Average
- Low.

Do not modify the motor power without the consent of your local Lely service provider.

Wheel diameter

Specifies the diameter of the wheels. The default diameter is 250 mm.

Do not modify this setting when the wheel diameter is not changed. This affects the route accuracy.

Beep length

This menu is used to set the duration of the beep. The default length is 200 mSec. This setting is for all routes. When the value is set to zero, the beep is switched OFF.

Reset report

This menu resets the service information data.

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Fill water

The menu 'Fill water' is used to:

- Set the 'Push power' (default 15.5 A). The power the Discovery exerts on the water filling station must be high enough to open the water valve without causing damage.
- Set the 'Pump current' (default 1000 mA). The pump must stop when the water tank is empty. When the pump current drops below the set value, the pump stops.
- Set the water fill function ('Water in use') 'On' or 'Off'. When this setting is 'Off', the Discovery does not stop at the water filling station when it starts a route. This setting can be used to clean the barn without the use of water, for example during periods of frost. When the setting is set to 'Off' the Discovery skips a visit to the water filling station and continues the route immediately.

4.3.5 Alarms

The Discovery monitors itself continuously and informs you about the situation. The Discovery generates alarms and reports.

Alarm List

The alarm list gives a summary of the alarms received. This list stores up to 250 alarms (page 8-1). Once 250 alarms are stored, the next alarm overwrites the oldest alarm of the list.

Report list

The report list gives a summary of the generated reports (page 8-9).

Info list

The list gives technical details. It is used by the service technician.

Reset list

To delete all alarm, report and info information.

4.3.6 Service

The menu 'Service' has the following sub menus:

- 'Hour counter' to display the hours in use since the last counter reset.
- 'Version' to display the software version
- 'Installation1' (password protected)
- 'Installation2' (password protected)
- 'Tests service' (password protected).

4.3.7 Test Route

The test procedure 'Test route' is used to test a selected route.

4.4 Operation

4.4.1 Routes, Actions, Manual Routes and Time Paths

Actions make a route

The Discovery drives through a barn along a programmed route. A route is build up of actions, for example 'Wall flw L' or 'Turn L <--'. A route in most cases starts, and always ends at the charging station (page 4-26) (1).

Automatic cleaning with a time path

The Discovery cleans the barn each day automatically on the same time if a time pathis set and switched ON (page 4-19).

Manual cleaning with manual routes

It is useful to enable 'MANUAL ROUTE'. You then can clean a part of the barn whenever you want or test a route (page 4-12). It is also useful to program routes from different points in the barn back to the charging station for instance to pick up a lost vehicle.

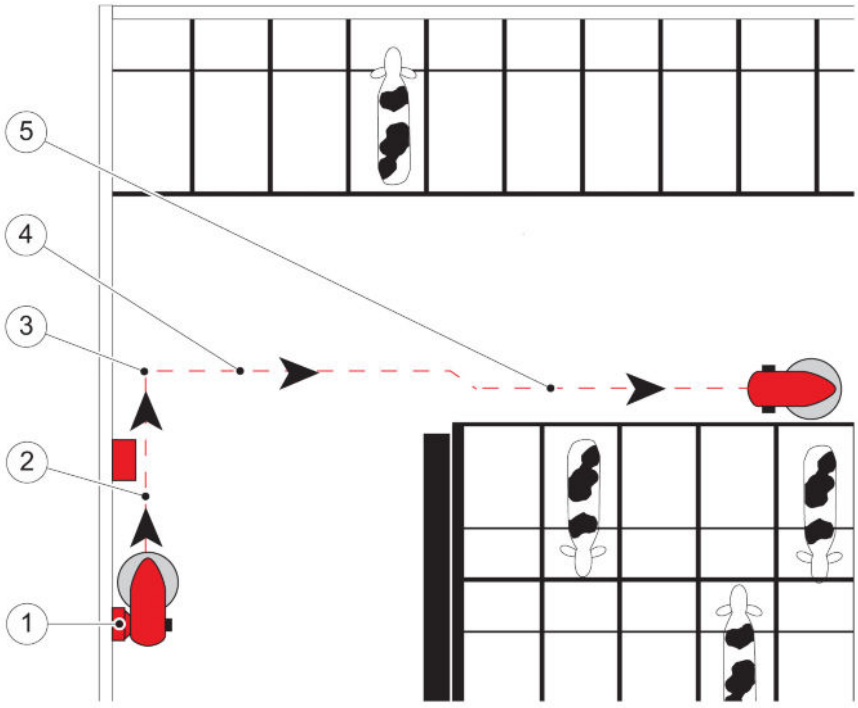

Figure 12. Actions make a route

KEY:
1. Charging station - 2. Wall flw L - 3. Turn R --> - 4. Straight - 5. Wall flw R

4.4.2 Control System

The control system keeps the vehicle on the right track.

4.4.2.1 Driving Distance

The encoders on the drive motor measure the number of rotations of the motor shafts. This value is used to calculate the travelled distance. If, due to

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slip, the actual driving distance is less than calculated, it can only be corrected if the action ends at a bump point (a collision point with a wall). If an expected bump point is not reached, the Discovery continues driving for a limited distance.

The driving distance is corrected in the software, so the next time the Discovery drives a bit further. On the other hand, if a bump point is reached earlier than expected, it is also corrected. These corrections are deleted when you reset the ADS 3840 PCB.

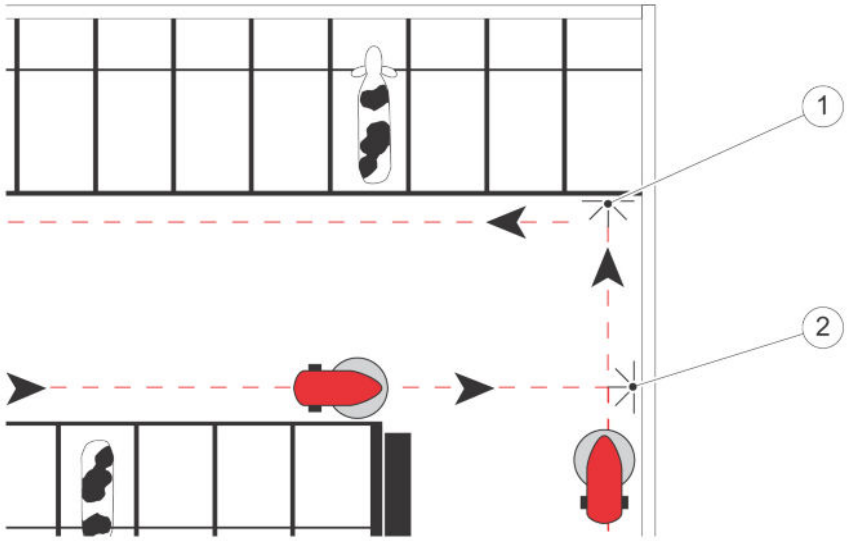

Figure 13. Bump points to correct the driving distance

KEY:
1.Bump point - 2. Bump point

4.4.2.2 Speed

The number of revolutions of the motors are also used to calculate the speed. The speed can be set for a route or for an action in a route.

4.4.2.3 Distance to a Wall

The ultrasonic sensor sends a pulsed ultrasound wave at an object and then measures the time for the sound echo to return (page 4-5).

4.4.2.4 Direction

At the start of a route, the angle with the wall is 0°. During the route the gyroscope calculates each deviation from a straight line (page 4-5). This information is used to control the direction of the vehicle. This is especially important during so called 'short actions', when there is no contact with the wall.

Short actions

Short actions are:

- 'Straight'
- 'Turn L <--'
- 'Turn R -->'.

Due to a combination of factors like skidding, obstacles or drift from gyroscope, the calculated angle with the wall may differ from the actual angle. This can cause the vehicle to drive in the wrong direction. This is no problem if the control system is able to correct itself during a 'long action'

Long actions

Direct wall contact with the sensing wheel or indirect wall contact with the ultrasonic sensor are used to keep the Discovery in the correct direction. This is the case during:

- 'Water filling'
- 'Wall flw L'
- 'Wall flw R'
- 'Ultrasound L' (or 'Ultrasound R' or 'Ultrasound L+R')
- 'Charger'.

If these actions continue for more than 10 m (33 ft) they are called 'long actions' because then the vehicle passes the 'reset point' (between 3 and 10 m (9.8 and 33 ft)). At that point the angle is reset to 0° and a beep is sound.

'Long actions' compensate for the deviations caused by 'short actions'. It is therefore very important to program a subsequent 'long action' after a succession of 'short actions'.

In a situation with a succession of 'short actions' ('Straight', 'Turn L <--' and 'Turn R -->') the vehicle can get lost, due to an accumulation of errors. In the figure (page 4-29), the left part shows a programmed route (example). The right part shows what could happen.

The risk of deviating from the programmed route can be minimized when (page 4-30):

- The Discovery has contact with the wall, barn or feed fence, either direct ('Wall flw L' or 'Wall flw R') or indirect ('Ultrasound L').
- Bump points enable the control system to compare the traveled distance with its own information.
- 'Short actions' are mixed with 'Long actions' to correct the direction.

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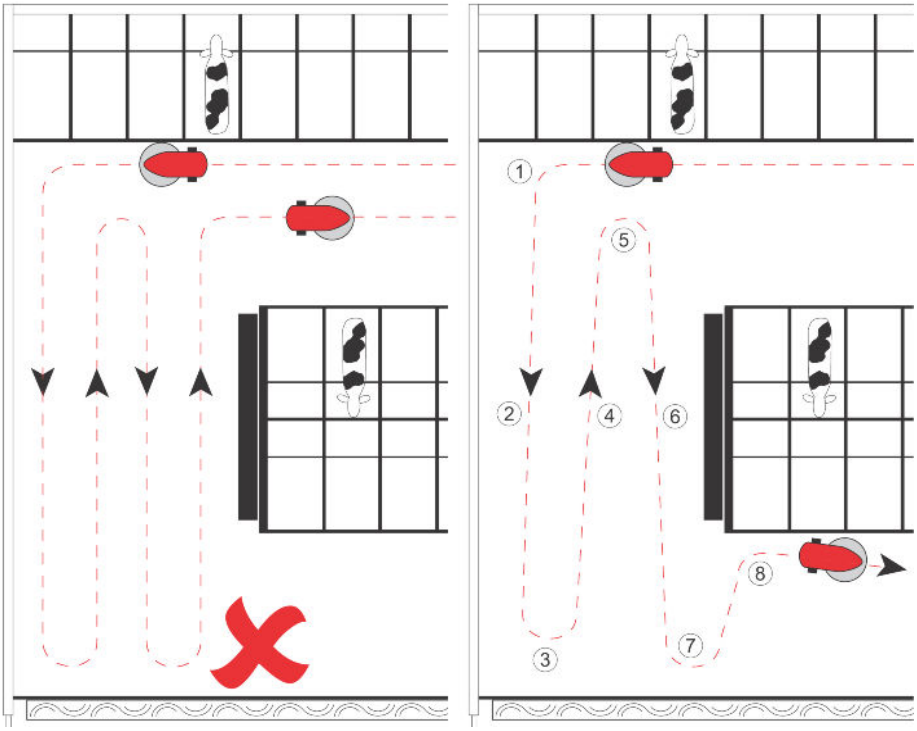

Figure 14. Example situation of short routes resulting in errors; left side: programmed route, right side: resulting route

Number	Explanation
1	The vehicle doesn't reach the wall, due to skidding. There is no bump point to correct this error.
3, 5, 7	Due to deviations in the gyroscope (drift) and/or skidding the turns are less than 180 degrees.
2, 4, 6	The errors are not corrected while driving straight.
8	The vehicle bumps the cubicle, tries to go on and eventually gets lost.

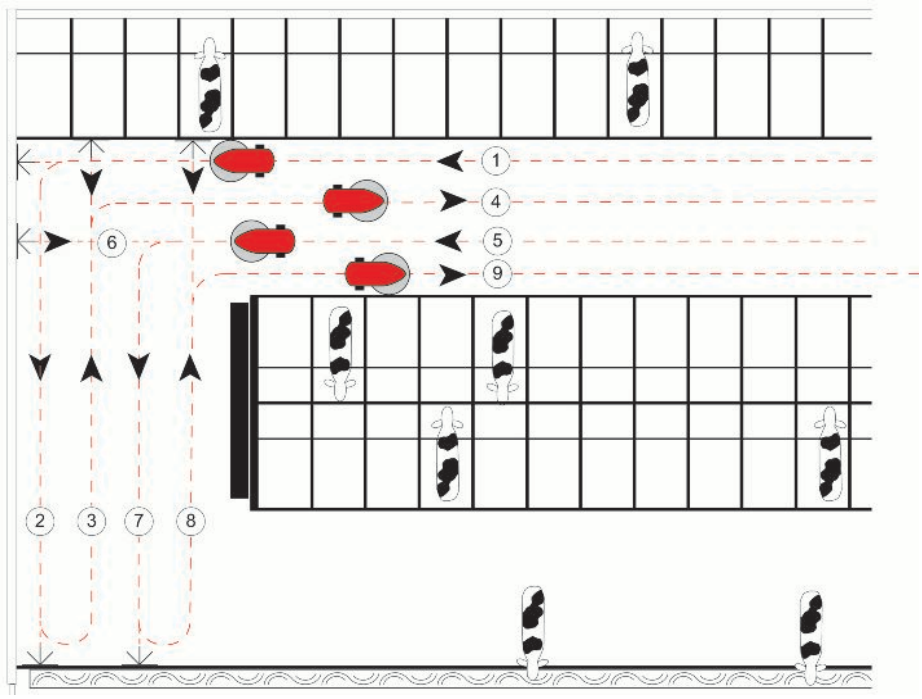

Figure 15. Alternation of short and long actions

Number	Explanation
1	The vehicle follows the cubicles on the right side until the wall (bump point)
2	The vehicle follows the wall on the right side until the feed fence (bump point), followed by 'Turn L <--'
3	The vehicle follows the wall on the left side ('Ultrasound L'), until the cubicles (bump point)
4	The vehicle drives back and follows the cubicles on the left side ('Ultrasound L')
5	The vehicle follows the cubicles on the left side with 'Ultrasound L' followed by 'Straight' until the wall (bump point)
6	The vehicle drives back followed by 'Turn L <--'
7	The vehicle drives 'Straight' until the feed fence (bump point) followed by 'Turn L <--'
8	The vehicle drives 'Straight' until the start of the cubicles on the right, then 'Wall flw R', followed by 'Straight' until the bump point
9	The vehicle drives back followed by 'Wall flw R'

4.4.2.5 Obstacles

If the Discovery unexpectedly comes across an obstacle, for example the leg of a cow or a pile of manure, the Discovery acts as follows:

- it reverses and tries again (up to 3 times)
- it reverses and makes a 45 degrees turn to the left or right, depending on the previous action (left or right wall tracking/ultrasonic). If it succeeds in passing the obstacle, it returns to the original route and continues to finish the route.

4.4.3 Power and Water Supply

At the end of a route, the Discovery drives to the charging station. It stays there until the start of the next route.

Each time the Discovery starts a route, it first drives to the water filling station (1). The water inlet tube enters the funnel shaped water supply tube and opens the mechanically operated shut-off valve. The vehicle stops automatically. The water enters the water tank via a water filter.

When the tank is full, it overflows through the air feed tube. The water sensor makes sure the Discovery drives back (2) from the water filling station and thereby stops the water filling process.

After that, the Discovery turns to the right (3), drives alongside the water filling station (4) and (5) and continues its route (6).

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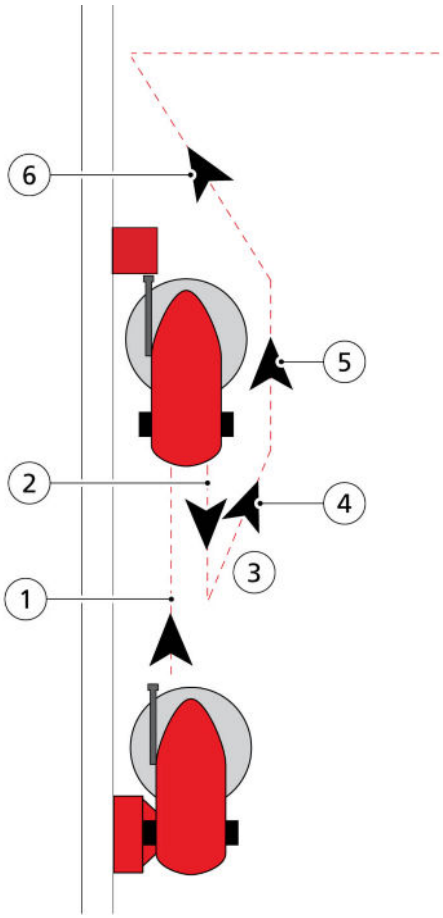

Figure 16. Start of a route

4.4.4 Cleaning

The two nozzles spray water just in front of the manure scraper to soften the manure. The manure scraper pushes the manure over the slatted floor until it falls through the gaps.

5. OPERATING INSTRUCTIONS

5.1 Install or Update the Lely Control app on Your Smart Phone

1. On the smartphone go to the Google play store.
2. Download the Lely Control app.
3. Install the app.
4. Wait until the software is correctly installed.
5. The first time you start to control the Discovery with the software on the smartphone, you must enter a password for the Discovery system. Ask your local Lely service provider for the password.

If there is new software available, a notification is displayed on the icon of the Google play store.

5.2 Rename the Discovery on the Smartphone

The device name of the Discovery that is displayed on the smartphone can only be modified by a certified Lely technician.

5.3 Set the farmer password

The farmer password must be set by a certified Lely technician.

It is recommended to use the same password for all smartphone controlled machines on a farm.

5.4 Switch ON or OFF the Discovery

To switch OFF

1. Remove the upper cover.
2. Remove the lower cover.
3. On the PCB box, push the button [**OFF**] to switch OFF the power.
4. Reinstall the lower cover.
5. Reinstall the upper cover.

To switch ON

1. Remove the upper cover.
2. Remove the lower cover
3. On the PCB box, push the button [**ON**] to switch ON the power.
4. Reinstall the lower cover.
5. Reinstall the upper cover.

5.5 Operate Device Specific Software with a Smartphone

Connect the Smartphone

1. Make sure the App is installed on your smartphone.
2. Make sure the Discovery is in your line of sight before you start the software.
3. Start the software on your smartphone (page 5-2).

Disconnect the Smartphone

1. Stop the software on your smartphone.

5.6 Start the Software on Your Smartphone

Remote Operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.

Make sure the machine is in your line of sight.

Make sure you are in the vicinity of the Discovery when you want to connect the phone to the machine. If the distance is too big, it will not appear in the list on the smartphone display.

The device name of the Discovery that is displayed on the smartphone can only be modified by a certified Lely technician.

Sometimes the phone must be paired with the Discovery before you can do the procedure below.

The Discovery can not be connected to more than 1 smartphone simultaneously.

On the Smartphone:

1. Start the Lely Control app.
2. If bluetooth was not in operation the following question (or similar) appears: 'The application tries to switch on bluetooth, continue?'
3. Push 'Yes'.

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4. Push the line: 'Search for devices'. The devices near the smartphone will be found. If one or more devices are not found, repeat this step.
5. Push the line with the machine you want to operate. A connection will be made with the selected machine. A green light is displayed in the title when the connection is made. The smartphone shows a set of control buttons and a display that can be used to operate the software. If the smartphone loses connection the green light turns red. Move towards the machine and make the connection again.
6. Push ↵
7. If the Discovery was switched OFF, Calibrate the gyroscope.

In general the buttons have the following function:

- [○] Execute the command on the display above the applicable soft button.
- [**START/STOP**] starts or stops an action.
- [△] moves the selector up one item or increases a value by one.
- [▽] moves the selector down one item or decreases a value by one.
- ↵ opens the selected function or the next menu screen.
- [ESC] returns to the previous screen.
- reduces the speed of the vehicle.

5.7 Manually Drive the Discovery

1. Stop all timed actions (page 5-25).
2. Push [↵] twice to select the menu 'Manual driving'.
3. The message 'SAFETY WARNING. Manual operation is permitted only with a clear overview of the vehicle. Confirm?' appears on the smartphone display.
4. Confirm if you have a clear overview of the Discovery.
5. In the menu 'Manual driving', push:
   - [**L**] to turn right, or
   - [**R**] to turn left, or
   - [**L**] and [**R**] to go straight on.
6. Push [⬆] to change the direction, if necessary.
7. Push [**START/STOP**] to start, hold it.
8. Release [**START/STOP**] to stop.

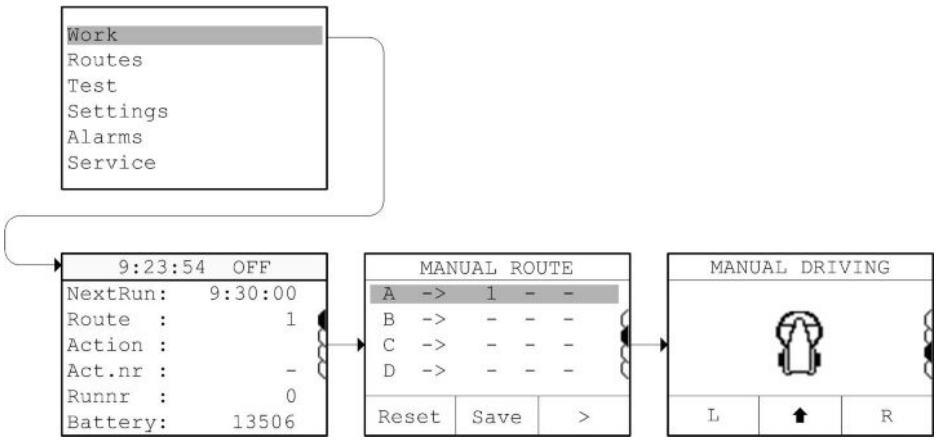

Figure 17. Manual driving

5.8 Drive the Discovery to the Charging Station

1. Stop all timed actions (page 5-25).
2. Manually drive the Discovery to 1.5 - 3 m (5 -10 ft.) from the charging station (page 5-3).
3. Make sure the front of the vehicle points in the direction of the charging station.
4. Push button [↵] to select the menu 'MANUAL CHARGER'.
5. Push:
    1. [L] if the charging station is on the left side
    2. [R] if the charging station is on the right side.
6. Push [**START/STOP**] to start.

The Discovery approaches the charging station and stops by itself.

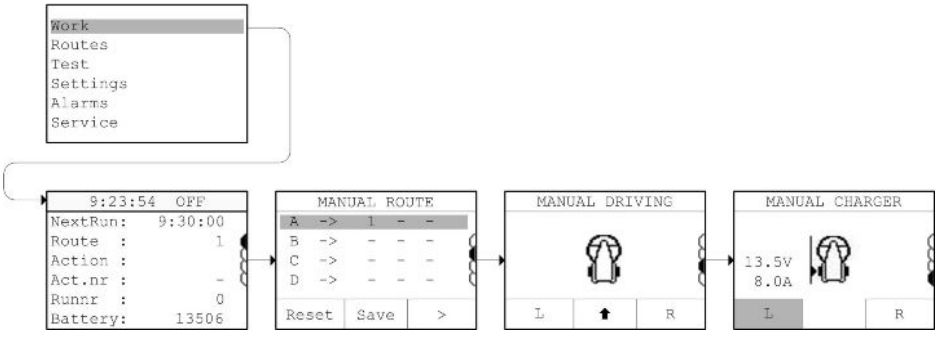

Figure 18. Manual charger

5.9 Switch ON of OFF the Water Filling Function in the Wintertime

The water filling function must be switched Off and the header tank and the water tank must be drained before the environmental temperature drops

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below freezing point. Lely Industries N.V. will not take any liability for damage due to frost.

1. Switch off the water supply to the header tank.
2. Push against the water outlet of the water filling station until the header tank is empty.
3. Set the water fill function 'On' or 'Off' (page 7-2).

5.10 Prepare for Programming

5.10.1 Requirements for a Good Route

Make it possible for the Discovery to correct itself

- Include as many bump points as possible in all directions. If, due to slipping, the bump point is not reached in time, the Discovery continues until the bump point is reached. This improves the reliability of the route.
- Be aware that actions like 'turn' and 'straight' may cause inaccurate results. Make sure the vehicle cannot get stuck after making a turn or driving straight. Program a 'long action' (wall contact: 'wall follow' or 'ultrasound') after a 'short action' (no wall contact: 'turn' or 'straight').
- If the vehicle follows the wall or cubicle row ('wall follow' or 'ultrasound') and if there is a bend, stop the vehicle, program a turn and go on to follow the wall (page 5-14).

Make it easy for yourself

- Program routes from different positions in the barn back to the charging station. This will enable you to easily return the vehicle back to the charging station in case it gets lost.
- Make a backup after programming a route.

Adapt the route or settings to the herd

- The beep can be modified separate for each route. If the beep length is set to 0, the beep is switched is OFF. If a warning signal is given, the cows have time to move out of the way. However, the sound may equally well disturb other cows (see which settings suit your herd best).
- Set the speed to a lower level for parts of the route or the whole route if the cows are disturbed (page 5-27).

Only spray water when needed

The water tank capacity is 30 L (7.9 gal), which is enough for approximately 30 minutes of spraying. As a result the Discovery must return to the water filling station (and the charging station) for a refill.

5.10.2 Example Routes, Barn with Milking Robot

In the example situation, the barn is divided into 3 areas. The time path has different routes to clean each area:

Route 1

The area behind the cubicles is most extensively polluted (page 5-6). It should be cleaned each hour at least.

Route 2

The walking alley should be cleaned 4 times a day (page 5-7). Because the area behind the cubicles should be cleaned often, the route combines cleaning the walking area and the area behind the cubicles.
It is useful to clean the walking area just before you enter the stall, for instance at 7:00, 12:00, 17:00 and 22:00 hour.

Route 3

The area between the cubicles and the feeding fence should be cleaned no more than 2 times a day, preferably at night (page 5-7). Cows should not be disturbed when eating.

The following example time path is based on these routes:

Time	Route
12:00	2
13:00	1
14:00	1
15:00	1
16:00	1
17:00	2
18:00	1
19:00	1
20:00	1
21:00	1
22:00	2
23:00	1
00:00	1
01:00	3
02:00	1
03:00	1
04:00	2

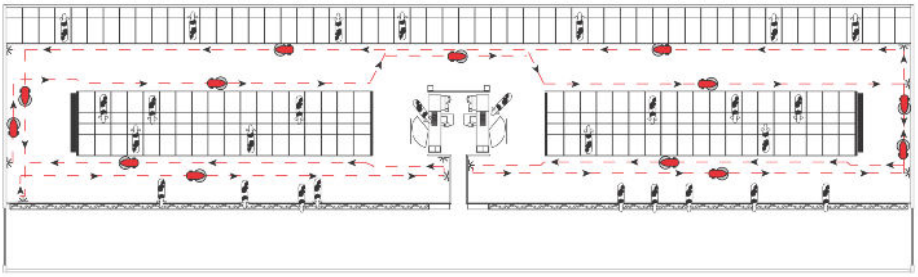

Figure 19. Route 1, clean all areas behind the cubicles each hour

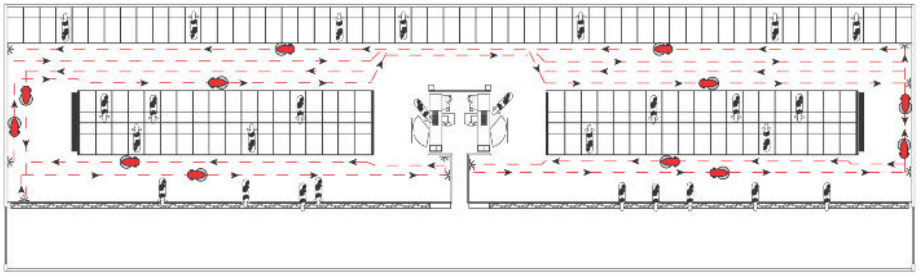

Figure 20. Route 2, like route 1, but also clean the walking alley, 4 times a day

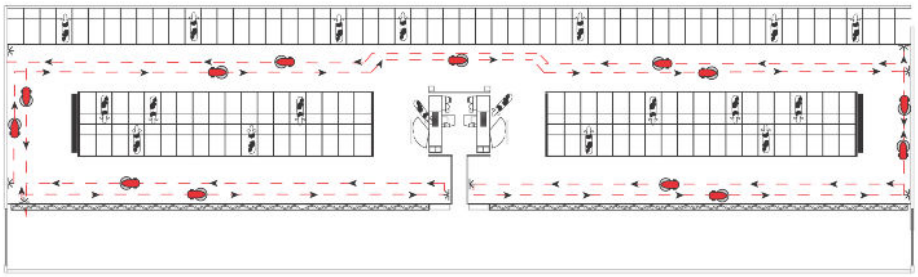

Figure 21. Route 3, clean the areas between the cubicles and the feed fence, 2 times a day

Each route is built of many actions. The following figure shows the actions of route 1 on the left side of the barn, the table below explains each action. Refer to the complete picture for an overview.

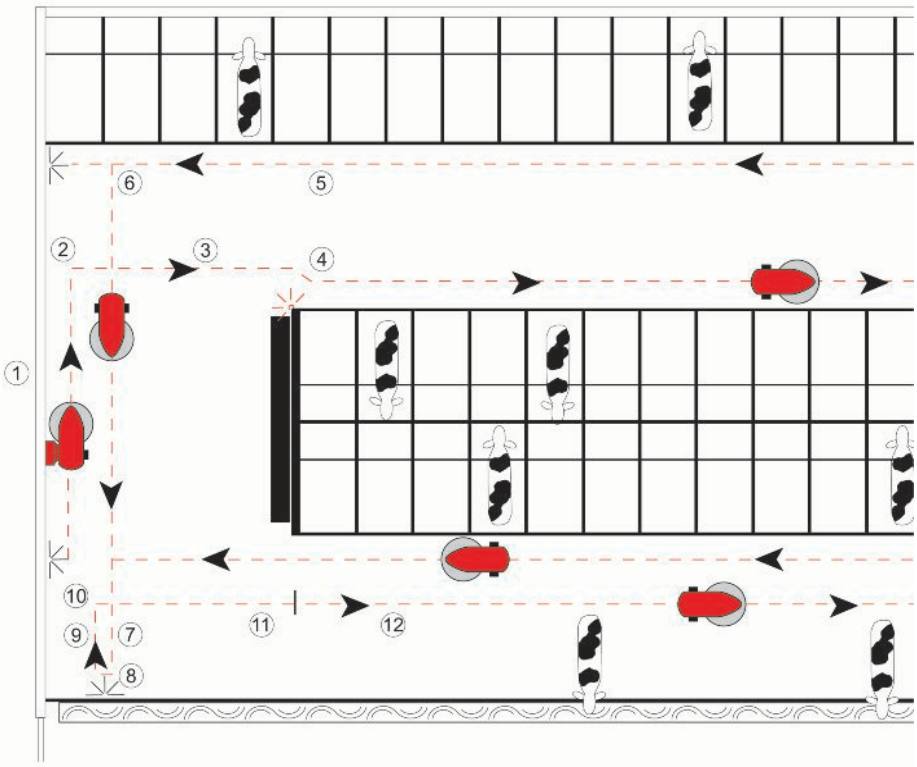

Figure 22. Example actions (left side)

Number	Action	Explanation
1	Wall flw L	Follow the wall is always the first action, necessary to leave the charging station
2	Turn R --> (90°)	Standard turn. Make sure the vehicle will not hit the cubicle wall after action 3. Else modify the turn (page 5-19)
3	Straight	Driving straight is the only option because the distance to a wall is more than 2 meter
4	Wall flw R	Vehicle will turn right until it hits the cubicle floor and will then follow the cubicle floor. Although it is easier to clean the left side first, this is not allowed because cows can get hurt, due to the opening for the ultrasonic sensor (page 5-15)
5	Wall flw R	Follow the cubicle floor until the wall (bump point)
6	Turn L <-- (90°, 1000 mm back)	Standard turn 90°. Modify turn: back 1000 mm before turning
7	Straight	Drive straight until the wall (bump point)
8	Turn R --> (180°)	Standard turn R (180°)
9	Straight	
10	Turn R --> (90°)	Standard turn 90°, modify if the nose of vehicle doesn't point in the correct direction
11	Straight	Straight until the first cubicle on the left side
12	Ultrasound L	Ultrasound drive (1100 mm)

The following figure (page 5-9) shows the actions of route 1 in the middle of the barn, the table below explains each action. Refer to the complete picture for an overview.

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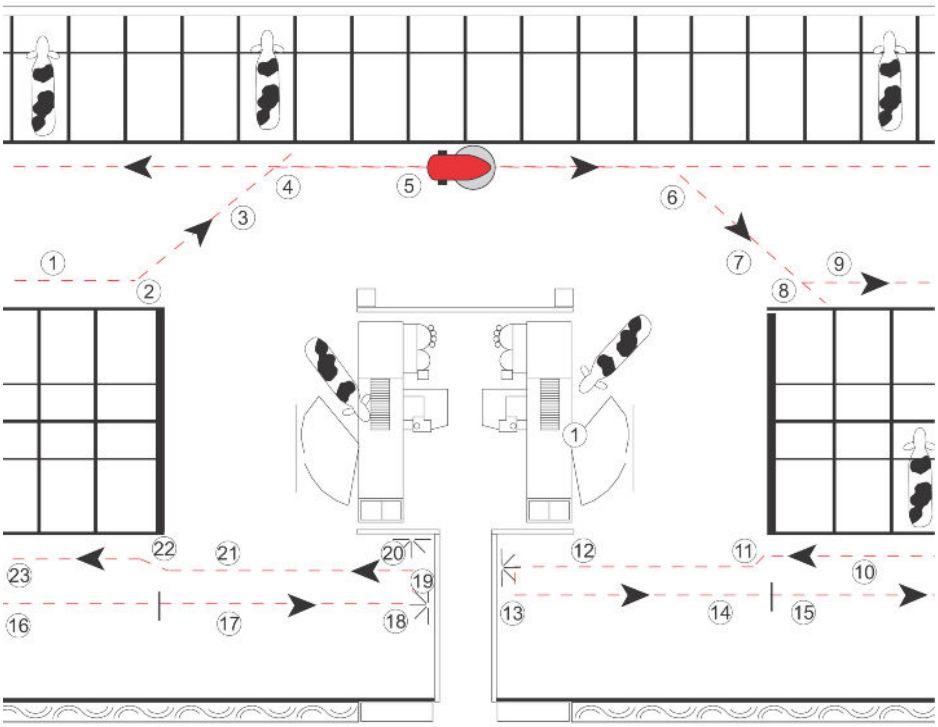


Figure 23. Example routes (middle part)

Number	Action	Explanation
1	Wall flw R	Follow the cubicle floor until the end of the cubicle row
2	Turn L <-- (45 degrees)	
3	Straight	Drive straight
4	Turn R --> (45 degrees)	
5	Wall flw L	Follow the cubicle floor
6	Turn R --> (45 degrees)	
7	Straight	Drive straight
8	Turn L <-- (45 degrees)	
9	Wall flw R	
10	Wall flw R	
11	Turn L <-- (10 degrees) Straight Turn R --> (5 degrees)	Move to the left to prevent hitting the wall after crossing over (page 5-11)
12	Straight	Drive straight until bump point
13	Turn L <-- (180 degrees)	Standard turn, stop in adjacent lane
14	Straight	
15	Ultrasound L	Ultrasound drive 1100 mm
16	Ultrasound L	Ultrasound drive 1100 mm
17	Straight	Drive straight until bump point
18	Turn L <-- (90 degrees)	
19	Wall flw R	Follow wall until bump point

Number	Action	Explanation
20	Turn L <-- (90 degrees)	Standard turn, back 500 mm
21	Straight	Drive straight until begin of cubicle row
22	Turn R --> (10 degrees)	
23	Wall flw R	

The following figure shows the actions of route 1 on the right side of the barn, the table below explains each action. Refer to the complete picture for an overview.

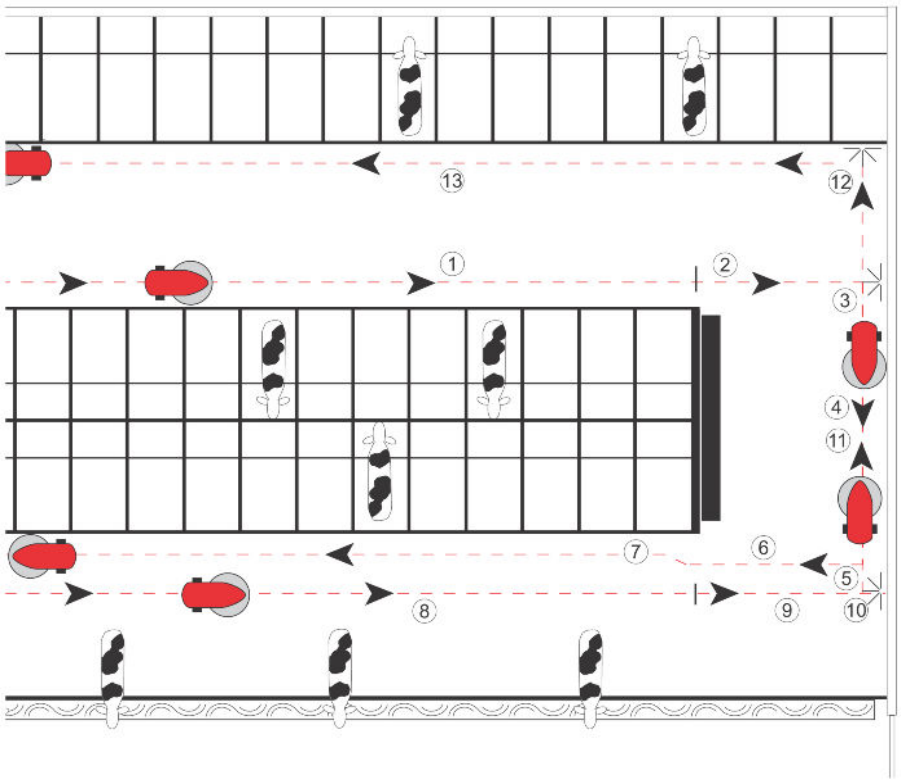


Figure 24. Example actions (right side)

Number	Action	Explanation
1	Wall flw R	Follow the wall until the end of the cubicle row
2	Straight	Drive straight until bump point
3	Turn R --> (90 degrees)	
4	Wall flw L	
5	Turn R --> (90 degrees)	
6	Straight	Drive straight until start of a cubicle row
7	Wall flw R	
8	Ultrasound L	Ultrasound drive 1100 mm until end of the cubicle row
9	Straight	Drive straight until bump point
10	Turn L <-- (90 degrees)	

Number	Action	Explanation
11	Wall flw R	Follow the wall until bump point
12	Turn L <-- (90 degrees)	
13	Wall flw R	

5.10.3 Example Route, Barn with Milking Parlour

In a barn with a milking parlour the situation is different from a barn with a milk robot. There is no free cow traffic to the milking parlour. If the cows are milked, a half of the barn is closed and can be cleaned.

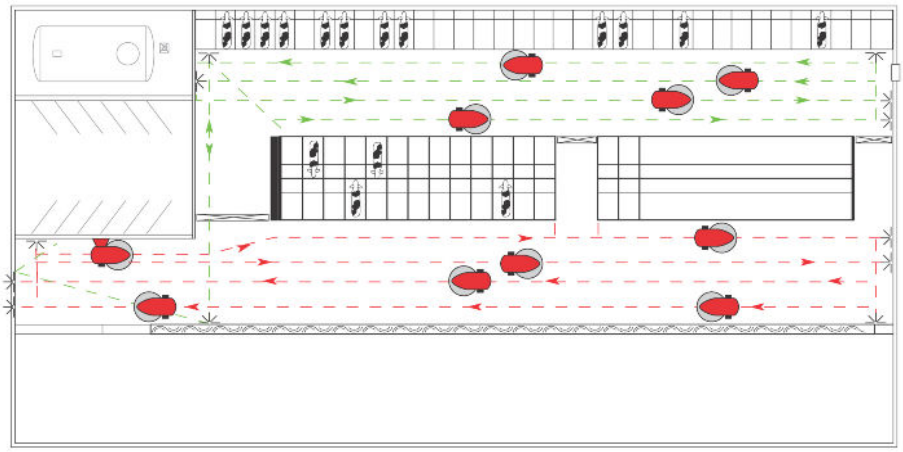


Figure 25. Example route, barn with milking parlour

5.10.4 To Pass a Crosswalk

If the Discovery passes a crosswalk between two cubicle rows, the direction must be corrected to avoid hitting the opposite cubicles. The next figure and the corresponding table with action show how to do this.

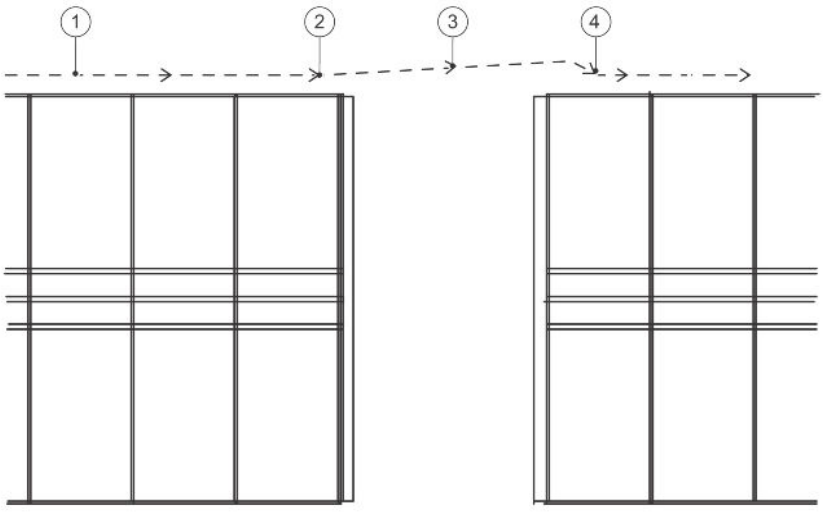


Figure 26. To pass a crosswalk

Number	Action	Explanation
1	Wall flw R	Follow the cubicles row, stop at the end
2	Turn L <--	Turn left, 5 degrees
3	Straight	Drive straight until middle of the next cubicle
4	Wall flw R	Follow the wall, the vehicle automatically turns to the cubicles

5.10.5 To make a Turn

Turn to clean the next (adjacent) lane

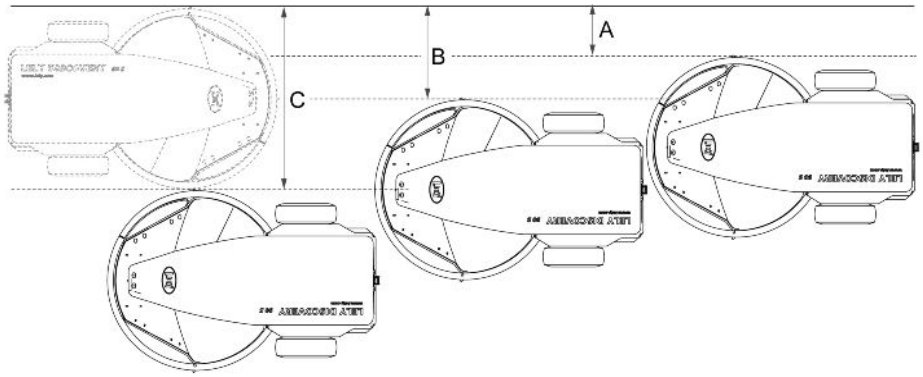
When the Discovery approaches a wall and must be turned 180 degrees to clean the next lane, it must:

- Hit the wall (bump point)
- Drive back to enable turning
- Turn 180 degrees with a certain radius.

You can choose from 4 standard turns, both left and right each with a different radius:

- Go back, turn 180 degrees, stop in the next lane 80 cm (31 in.) to the right or left (to clean the next lane)
- Go back, turn 180 degrees, stop in the next lane 40 cm (16 in.) to the right or left (to clean the next lane and also half of the former lane)
- Go back, turn 180 degrees, stop in the next lane 20 cm (8 in.) to the right or left (to clean the next lane and also three quarter of the former lane)
- Go back, turn 180 degrees, stop in the same lane (to clean the same lane again).

The next figure shows the options.



KEY:
A. 20 cm (8 in.) - B. 40cm (16 in.) - C. 80 cm (31 in.)

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5.10.6 To Approach the Charging Station from the Opposite Direction

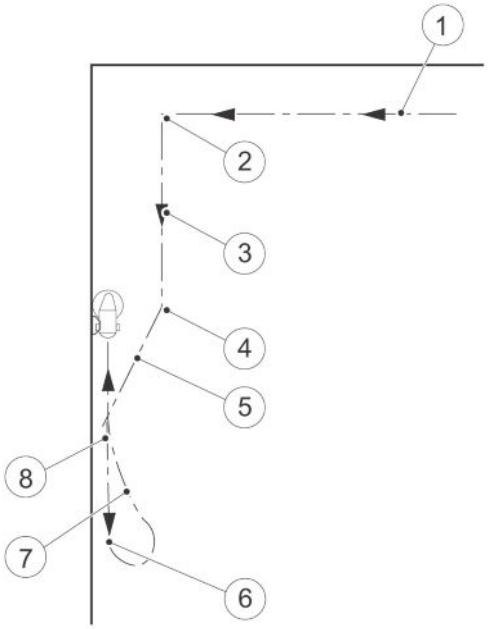

Figure 27. Approach the charging station

Number	Action	Explanation
1	Wall flw R	Follow the wall on the right side
2	Turn L <--	Turn left
3	Straight	Drive straight
4	Turn R -->	Turn R 20 degrees
5	Wall flw R	Follow the wall on the right side
6	Turn L <--	Turn L 180 degrees
7	Wall flw L	Follow the wall until 1.5 - 3 m (5 - 10 ft.) from the charging station
8	Charger	Go to the charging station

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5.10.7 To Follow a Bend in a Wall

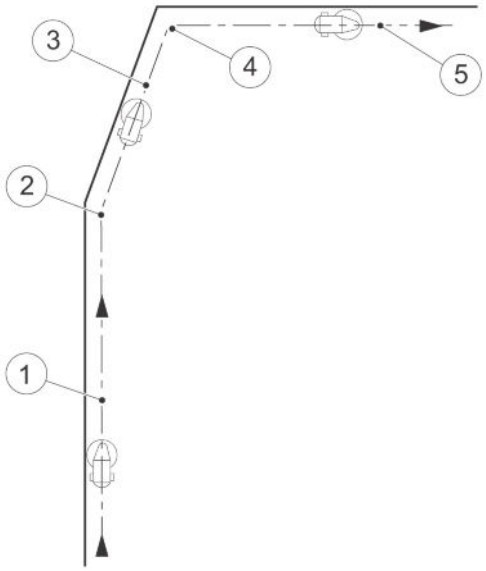

Figure 28. Follow a bend in a wall

Number	Action	Explanation
1	Wall flw L	Wall follow
2	[**START/STOP**]	Stop the wall follow action
3	Wall flw L	Wall follow (no turn action needed because the angle < 20 degrees)
4	Turn R -->	Turn right, nose in drive direction
5	Wall flw L	Wall follow

5.11 Program the Discovery

5.11.1 Program a New Route

Preparation

1. Make sure you understand the requirements for setting up a good route (page 5-5).
2. Plan the route on a piece of paper.
3. Open (page 5-2) the Lely Control app on the smartphone
4. Stop all timed actions (page 5-25).

Program

1. In the main menu of the Lely Control app, select 'Routes' and push [↵].
2. Select menu 'New route' and push [↵].

If the the vehicle is not connected to the charging station, you can push soft button [**CHARGR**] to drive the Discovery to the charging station (page 5-3).

3. Push soft button [**START**].
4. Read the messages on the display and push [↵] (2×).
5. Program the first action ('Water filling').
6. Program the next action in the route:
   - 'Water filling'
   - 'Wall flw L'
   - 'Wall flw R' (page 5-15)
   - 'Straight'
   - 'Turn R -->'
   - 'Turn L <--'
   - 'Ultrasound L' or 'Ultrasound R' or 'Ultrasound L+R'
   - 'Charger'.
7. If the vehicle has returned to the charging station within 1 - 3 m (3.2 - 9.8 ft), go to the charging station (page 5-21),
   Else repeat step 6.
8. Push soft button [**Exit**].
9. Push soft button [Yes] to save the new route.

Close-up

1. Test the route (page 7-4).
2. Make a backup of the route.

5.11.1.1 Follow a Wall (Left or Right)

Try to avoid to move past cows on the left side, they may get hurt due to the opening for the ultrasonic sensor (page 5-16).

If the angle between the Discovery and the wall is more than 30 degrees, you must program a 'turn' action first before you program a 'follow wall' action (page 5-17).

1. If the wall is:
   - On the left side, select the menu 'Wall Flw L' and push [↵]
   - On the right side, select the menu 'Wall Flw R' and push [↵].
2. Push [**START/STOP**] to start.

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Build in as many bump points as possible in all driving directions.

3. If the Discovery approaches a bump point (approx. 30 cm (12 in)), push [ ] to smoothly reduce speed.
4. Push [**START/STOP**] to stop the Discovery immediately.

The display shows the status ('Manual stop' or 'Bump stop') and the travelled distance (in mm).

5. Push soft button [**Save**].

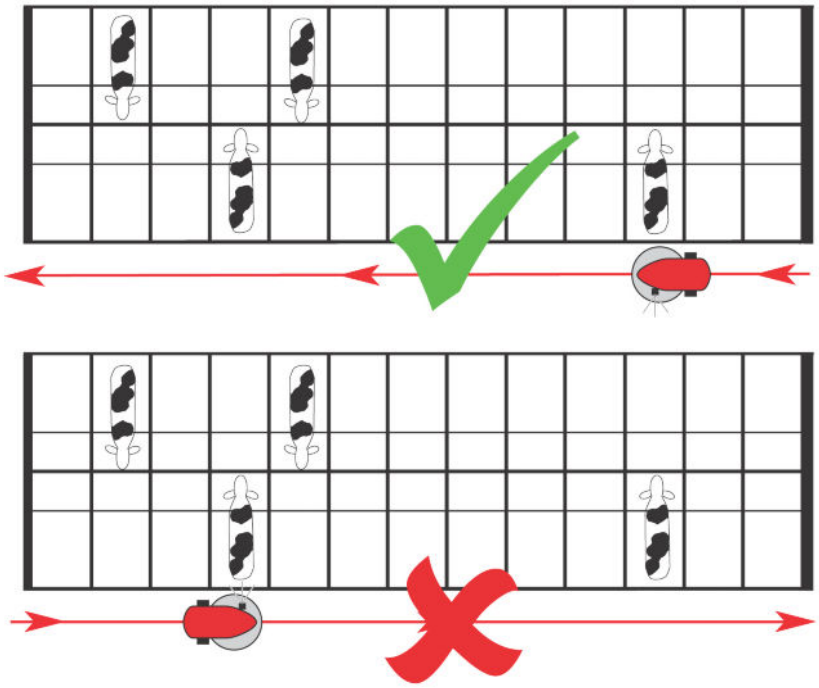

Figure 29. Try to avoid to move past cows on the left side

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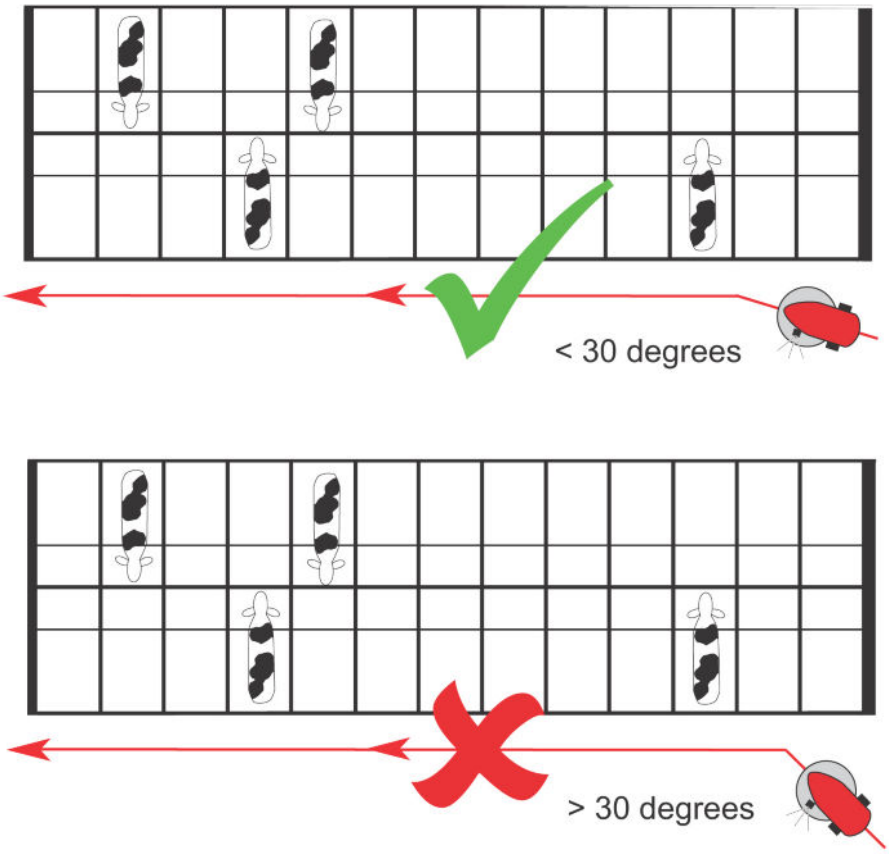

Figure 30. Never make an angled start (>30 degrees)

5.11.1.2 Go Straight

When moving straight forward, the deviation can be more than 10%. Take this into account when you set up a route. If possible, include a bump point after going straight.

Before starting, make sure the Discovery points in the correct direction. Use the "Straight' option as little as possible. If it really is necessary, for example to get the Discovery through a doorway, make the distance travelled as short as possible. Once through the doorway, continue to follow a wall left or right, or ' Ultrasound L'. This improves the accuracy of the route that is travelled.

1. Select 'Straight' and push [↵].
2. Push [**START/STOP**] to start.
3. If the vehicle approaches the wall from an angle,
    1. Push [**START/STOP**].
    2. Turn the vehicle to a right-angled position to the wall (page 5-19).
    3. Resume driving 'Straight'.
4. If the Discovery approaches a bump point (approx. 30 cm (12 in)), push [ ] to smoothly reduce speed.
5. Push [**START/STOP**] to stop the Discovery immediately.

The display shows the status ('Manual stop' or 'Bump stop') and the travelled distance (in mm).

6. Push soft button [**MAN**] to modify the position.
    1. Push soft button . to turn left, or . to turn right.
    2. Push [**ESC**] to confirm and go one level up.
7. Push soft button [**Save**].

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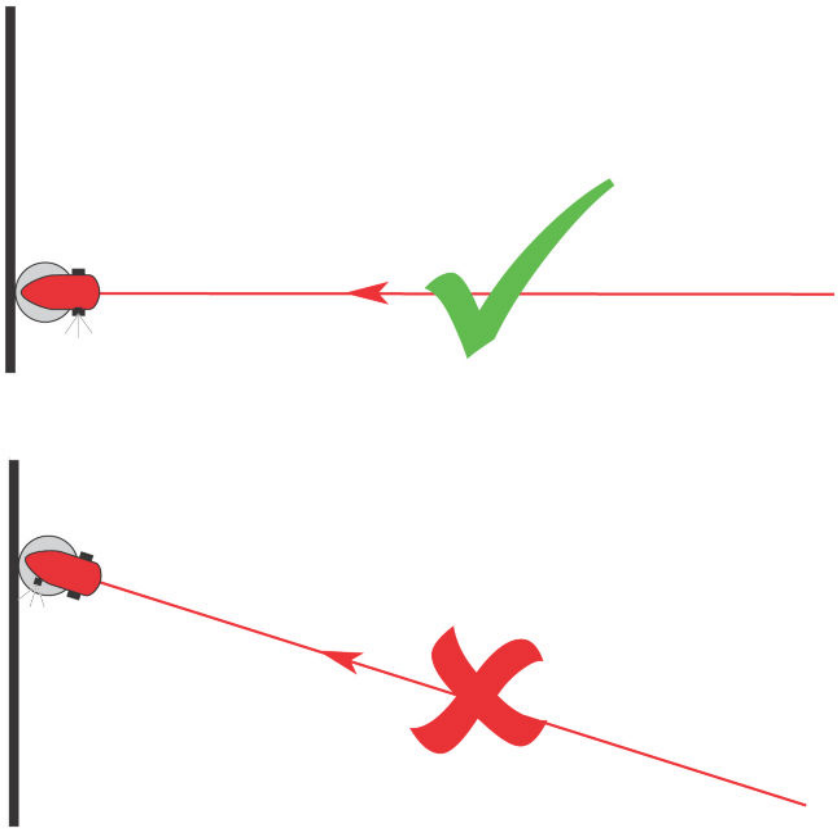

Figure 31. Avoid angled bumping

5.11.1.3 Turn Left or Right

1. If you want to turn left, select 'Turn L <--' and push [↵].
2. If you want to turn right, select 'Turn R -->' and push [↵].
3. Read the message on the display and push [↵].

You can choose from 12 standard turns and modify the turn afterwards. Preferably do not make sharp turns in heavy polluted areas (less power).

4. Push [↵] until the most appropriate standard turn is displayed, or push [**ESC**] to go to the previous display.
5. Select one of the standard turns with the appropriate soft button (page 4-16).
6. If you want to modify the turn, push [△] or [▽] to select the angle.
7. If you want to drive back before making a turn:
   1. Push soft button [**>**] to select 'Back'.
   2. Push [△] or [▽] to select the reverse distance.
8. If you want to modify the radius of a turn:
   1. Push soft button [**>**] to select 'Radius'.
   2. Push [△] or [▽] to select the radius.
9. Push [**START/STOP**] to start.

If the made turn is not exactly as planned, modify the position (see the next step). This is above all important if the angle is 90 or 180 degrees left or right.

10. Push soft button [**MAN**] to modify the position.
    1. Push soft button to turn left, or to turn right.
    2. Push [**ESC**] to confirm and go one level up.
11. Push soft button [**Save**].

5.11.1.4 Follow a Wall or Fence on a Certain Distance (Ultrasound)

Do not program Ultrasound L when the wall is more than 2 meters away.

1. Select the menu 'Ultrasound Land push[↵]
2. Read the actual distance to the wall (UltraDst) from the display.
3. Push [△] or [▽] to select the required distance to the wall (ULTRADST).
4. Push [**START/STOP**] to start.
5. If the Discovery approaches a bump point (approx. 30 cm (12 in)), push [ ] to smoothly reduce speed.
6. Push [**START/STOP**] to stop the Discovery immediately.

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The display shows the status ('Manual stop' or 'Bump stop') and the travelled distance (in mm).

7. Push soft button [**MAN**] to modify the position.
   1. Push soft button ▵ to turn left, or ▿ to turn right.
   2. Push [**ESC**] to confirm and go one level up.
8. Push soft button [**Save**].

5.11.1.5 Go to the Charging Station (Charger)

1. Make sure the Discovery is within 1.5-3 m from the charging station, pointing towards it (page 5-3).
2. Select the menu 'Charger'.
3. Push soft button [**MAN**] to modify the position.
   1. Push soft button ▵ to turn left, or ▿ to turn right.
   2. Push [**ESC**] to confirm and go one level up.
4. If the charging station is on the right, push soft button [**L**].
5. Push [**START/STOP**] to start.

The Discovery approaches the charging station and stops by itself.

5.11.1.6 Waiting Time

1. Select the menu 'Waiting time'.
2. Push[△]or [▽] to select the waiting time.
3. Push soft button [**Save**].

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5.11.2 Copy a Route

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Routes' and push [↵].
4. Select Copy route and push [↵].
5. Select the route you want to copy and push [↵].
6. Push soft button [Yes] to confirm.

5.11.3 Modify a Route

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. Test the route (page 7-4).
4. In the main menu of the Lely Control app, select 'Routes' and push [↵].
5. Select Modify route and push [↵].

6. Select Modify route and push [↵].
7. Select the route you want to modify and push [↵].
8. Read the message and make sure to understand it.
9. Select the action you want to modify and push [↵].
10. If you want to add extra waiting time before the action:
    1. Select the action.
    2. Push soft button [New].
    3. Select Waiting time and push [↵].
    4. Modify the waiting time with [△] or [▽].
11. If you want to modify the driving distance or the turn:
    1. Select the action and push [↵].
    2. Select the property you want to modify with soft button [**<**].
    3. Modify the value of the property with [△] or [▽].
12. Push [**ESC**] to confirm and go one level up.
13. Push soft button [Yes] to confirm.

5.11.4 Reset a modified Route to the previous Version

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Routes' and push [↵].
4. Select 'Modify route' and push [↵].
5. Select 'Modify reset' and push [↵].
6. Select the route you want to reset and push [↵].
7. Push soft button [Yes] to confirm.

5.11.5 Delete a Route

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Routes' and push [↵].
4. Select Delete route and push [↵].
5. Select the route you want to delete and push [↵].
6. Push soft button [**Yes**] to confirm.

5.11.6 Set or Delete a Manual Route

Set a manual route to manually drive (a set of) route(s) or to test a route (page 4-12).

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Work' and push [↵].
4. Push [↵] to select the menu MANUAL ROUTE.

Set a Series of Routes

1. In the menu MANUAL ROUTE, push [▽] to select the series of routes you want to set (A, B, C or D).
2. Push soft button [**>**] to select the first route in the series.
3. Push [△] or [▽] to select the route number (page 4-13).
4. Repeat step 2 and 3 to select the next route in the series (if applicable).
5. Push soft button [**>**] twice.
6. Push [**Save**] to save the series of manual routes.

Delete a Manual Route

1. Push [△] or [▽] to select the route you want to delete.
2. Push soft button [**Reset**].

5.11.7 Set a Time Path

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Routes' and push [↵].
4. Select time path and push [↵].
   Refer to the time path description (page 4-19).

The Discovery must not drive more than 40% of the total time in a time path. It must spend minimum 60% of the total time charging at the charging station.

5. Push soft button [**New**].
6. Push soft button [**>**].
7. Push [△] to select the start time (hour) and push soft button [**>**].

8. Push [△] to select the start time (minutes) and push soft button [**>**].
9. Push [△] to select the route and push soft button [**>**].
10. If you want:
    - To add another route to the time path, push soft button [**New**] and repeat steps 7 to 11
    - Confirm an go up one level, push [**ESC**].
11. Push soft button [**Yes**] to save the new time path (page 4-19).

5.11.8 Make a Backup

Make a backup each time you changed a route or time path or when another smartphone is used. Backups are made on the smartphone.

Make sure to give each backup you make a unique name.

Make sure the phone has a proper connection with the Discovery and has enough storage space available for the backup file.

1. Stop all timed actions (page 5-25).
2. In the main menu of the Lely Control app, select 'Routes' and push [↵].
3. Select 'Backup route' and push [↵]. The question 'Backup or restore the current routes and settings? ' appears on the display of the smartphone.
4. Push soft button [**Bckup**]. The software asks if you want to make a backup on the smartphone.
5. Push soft button [**Yes**]. The smartphone displays a progress bar of the backup process.
6. Enter the name for the backup file.
7. Push soft button [OK].
8. Wait until the process ends with a beep.

5.11.9 Copy a Backup file from the Smartphone to a PC

1. Connect the smartphone to a usb port of the PC. Use the data cable of the smartphone to connect.
2. Use the PC to browse to the Lely backup folder on the smartphone.
3. Select the applicable backup file (.bkp).
4. Copy the backup file from the smartphone.
5. Paste the backup file to the pc.

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5.11.10 Copy a Backup file from a PC to the Smartphone

1. Connect the smartphone to a usb port of the PC. Use the data cable of the smartphone to connect.
2. Use the PC to browse to the location of the backup file (.bkp).
3. Copy the backup file from the PC.
4. Paste the backup file to the Lely backup folder on the smartphone.

5.12 Start or Stop Timed Actions

Remote Operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.

1. Open (page 5-2) the Lely Control app on the smartphone
2. In the main menu of the Lely Control app, select 'Work' and push [↵].

If the pane on the upper side of the menu, that displays the actual time, is grayed out, the timed actions are ON.

3. Push [**START/STOP**]. Or
4. Push the pause button on the Discovery to start/stop the timed actions of the Discovery.

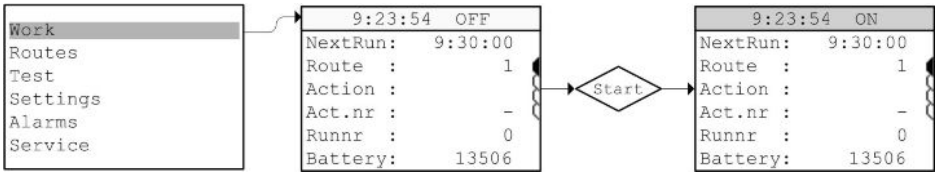

Figure 32. Start or stop timed actions

5.13 Start, Stop or Pause a Manual Route

Remote Operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.

To start a manual route:

1. Stop all timed actions (page 5-25).
2. In the main menu of the Lely Control app, select 'Work' and push [↵].
3. Push [↵] to select the menu 'Manual route'.
4. Push [▽] to select the series of routes (A, B, C or D).
5. Push [**START/STOP**].
6. If you want to switch ON the time path after the manual route, push soft button [**Yes**],
   Else push soft button [**No**].

To pause or stop a manual route:

1. Push [**START/STOP**] or the pause button on the Discovery.
2. If you want to:
   - Stop the route immediately, push soft button [**Yes**].
   - Resume the route, push soft button [**No**] or the pause button on the Discovery.
   - Pause,
     1. Push soft button [**Pause**].
     2. Push button [△] to select the number of minutes you want to pause.
3. Push soft button [**OK**].

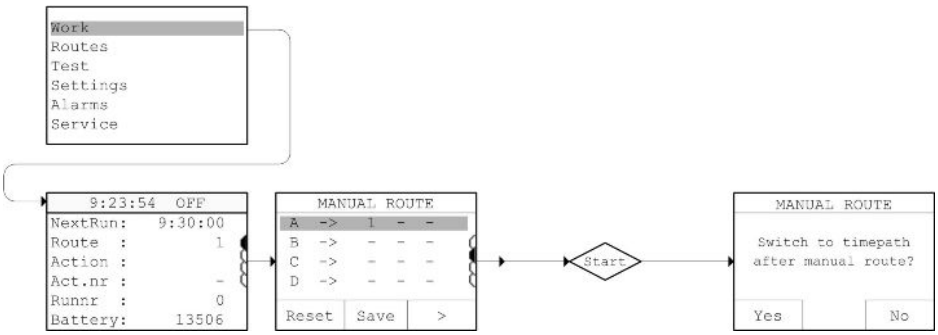

Figure 33. Start a manual route

5.14 Block a Route

1. Stop all timed actions (page 5-25).
2. In the main menu of the Lely Control app, select 'Routes' and push [↵].
3. Select 'Blockage route' and push [↵].
4. Push [▽] to select the route that you want to block and push [↵].
5. Push [△] to block the route (value 1) and push [**ESC**] to confirm and go one level up.

Blocking a route has no effect on Manual Route (page 5-25).

5.15 Set the Speed for a Route

1. Stop all timed actions (page 5-25).
2. In the main menu of the Lely Control app, select 'Routes' and push [↵].
3. Select 'Speed route' and push [↵].
4. Select the route that you want to change and push [↵].
5. Push [△] or [▽] to modify the speed.
6. Push [**ESC**] to confirm and go one level up.

5.16 Set the Speed for a Particular Action

1. Stop all timed actions (page 5-25).
2. In the main menu of the Lely Control app, select 'Routes' and push [↵].
3. Select 'Speed action' and push [↵].
4. Select the route that you want to change and push [↵].
5. Select the action that you want to change and push [↵].
6. Push [△] or [▽] to select the speed for that particular action.
7. Push [**ESC**] twice to confirm and go two levels up.
8. Push [**Yes**] to save the modification.
9. Push [**ESC**] to confirm and go one level up.

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6. MAINTENANCE

6.1 Introduction

This chapter contains the preventive maintenance schedule and the applicable preventive maintenance procedures for the Discovery. It also contains some basic corrective maintenance procedures.

6.2 Preventive Maintenance Schedule

The following table shows the preventive maintenance schedule for the Discovery. Preventive maintenance must obey local regulations, if applicable.

The frequencies of the tasks shown in the table are the minimum frequencies recommended.

Maintenance Tasks	Frequencies		
	Operating Weeks	Operating Months	Note
Clean the charging strips (page 6-2)	1		
Clean the charging electrodes on the charing station (page 6-2)	1		
Clean the water filter (page 6-3)	2		
Clean the nozzle filters (page 6-4)	2		
Read the report list and perform any indicated maintenance procedure (page 8-9)	2		
Check the drive chains and tighten if necessary (page 6-8)		1	Tighten new chains again after 2 days
Check the battery is charging (page 7-4)		1	
Clean the ultrasonic sensor (page 6-5)		1	
Replace the manure scraper (page 6-9)		3 - 6	Replace if broken or cleaning insufficient

6.3 Maintenance Procedures

Block the cow traffic to the Discovery before you do this procedure.

Danger of being entangled by rotating parts.
Keep hands, loose clothing, and long hair away from moving parts during operation of the Discovery.

6.3.1 Clean the Charging Strips and the Charging Electrodes

Make sure that after cleaning the charging electrodes slide over the middle of the charging strips when the Discovery parks.

Preparation

1. Disconnect the main power supply to the charging station.
2. Manually drive the Discovery to a clean and quiet location (page 5-3).
3. Switch OFF the Discovery (page 5-1).

Clean

1. Thoroughly clean the charging strips (1,2) of the Discovery with sand paper or a steel brush.
2. Thoroughly clean both electrodes of the charging station (3) with sand paper.

Close-up

1. Connect the charging station to the main power supply.
2. Switch ON the Discovery (page 5-1).

During the calibration process you must not move the Discovery.

3. Push soft button [**Yes**] to start the gyroscope calibration process.
4. Wait until a beep is heard (about 10 minutes) to confirm that the calibration is complete.
5. Manually drive the Discovery to the charging station.
6. Examine the charging electrodes slide over the middle of the charging strips when you park the Discovery.
7. Start the timed actions (page 5-25).

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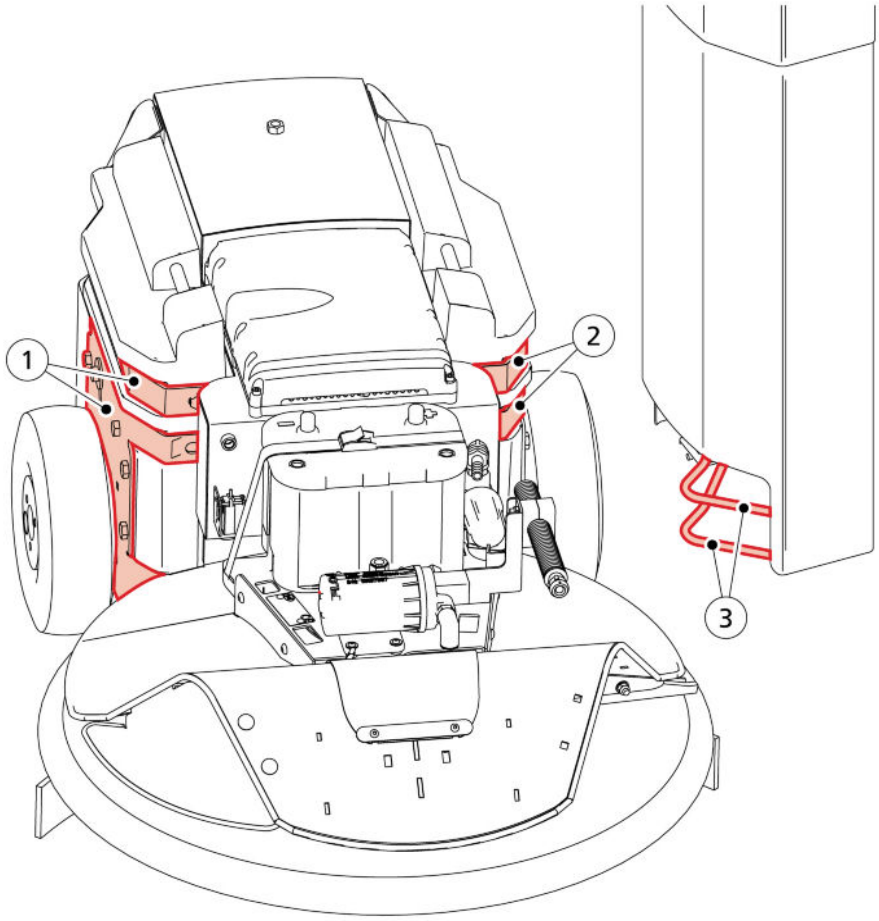

Figure 34. Clean the charging strips and the charging electrodes

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6.3.2 Clean the Water Filter

Make sure to reinstall the water filter properly after cleaning to avoid water damage.

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).
2. Remove the upper cover.

Clean

1. Turn the cap (1) counter clockwise to remove it from the filter housing.
2. Remove the filter (2) from the filter housing.
3. Clean the filter and the cap.
4. Install the filter in the filter housing.
5. Install the cap on the filter housing.

Close-up

1. Install the upper cover.
2. Manually drive the Discovery to the charging station (page 5-4).
3. Start the timed actions (page 5-25).

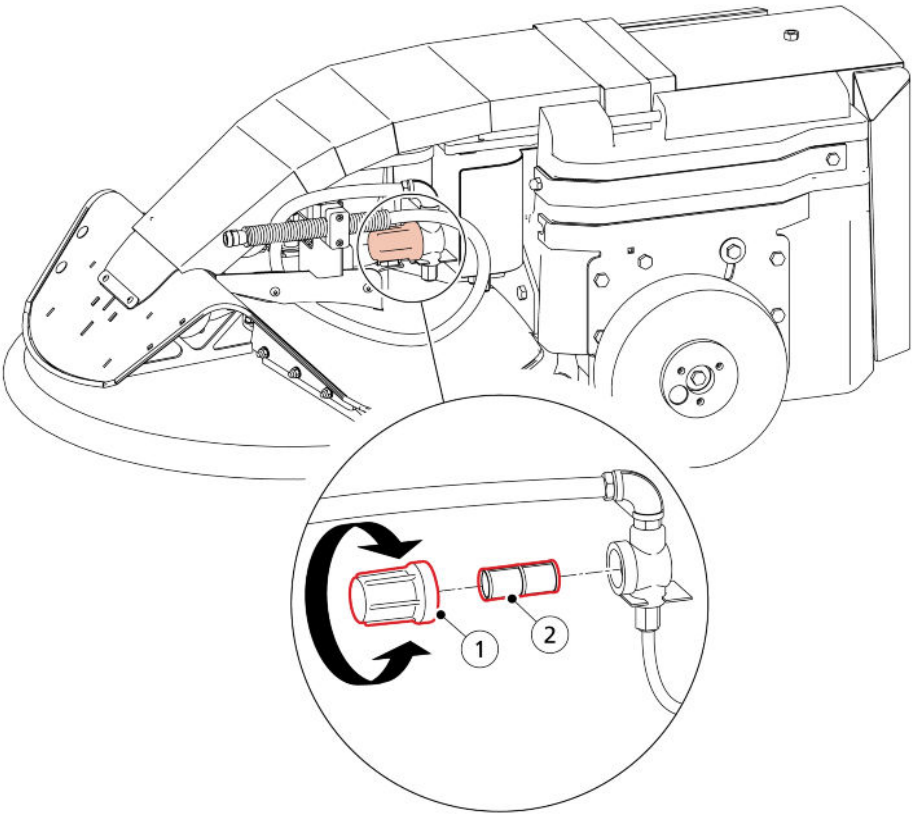

Figure 35. Clean the water filter

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6.3.3 Clean the Nozzle Filters

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).
2. Remove the cover.
3. Put the Discovery on its rear.

Clean

1. Clean the sensing wheel and the manure scraper (page 6-6).
2. Put the Discovery on its rear.
3. Remove the nozzle (3) from its base with a spanner.
4. Clean the filter (2) and the nozzle.
5. Install the nozzle on its base.
6. Repeat the cleaning procedure for the other nozzle.

Close-up

1. Put the Discovery on the floor.
2. Install the cover.
3. Manually drive the Discovery to the charging station (page 5-4).
4. Start the timed actions (page 5-25).

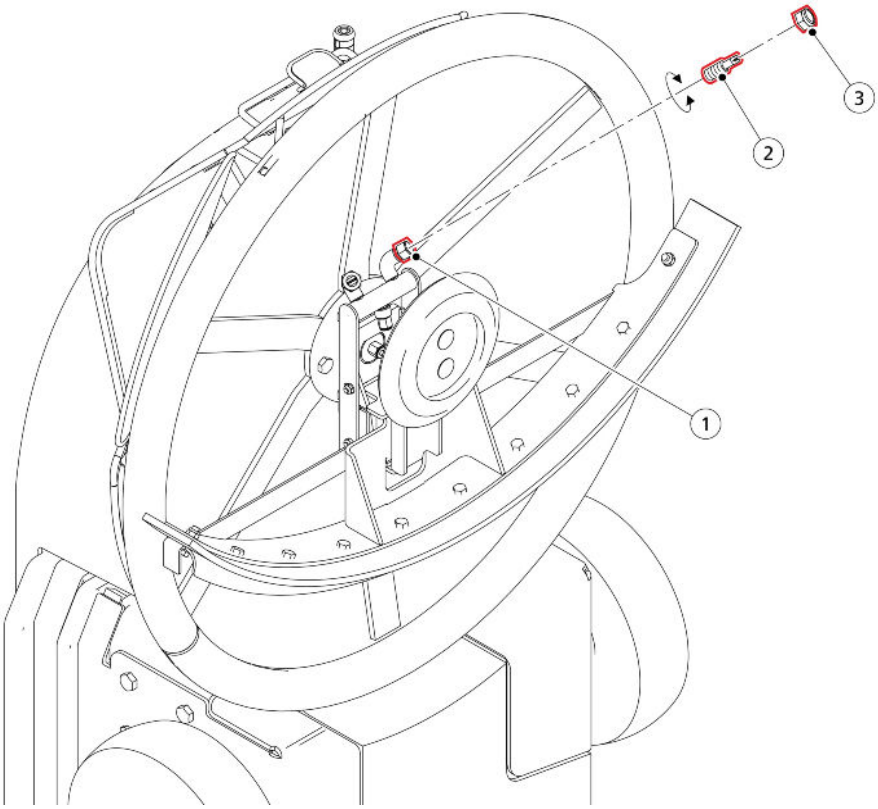

Figure 36. Clean the nozzle filters

6.3.4 Clean the Ultrasonic Sensor

Inspect the black foam ring on the ultrasonic sensor after cleaning. Replace the foam ring if it is damaged.

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).

Clean

Do not use sharp objects to clean the ultrasonic sensor.

1. Clean the ultrasonic sensor with a tissue via the ultrasonic sensor opening.

Close-up

1. Manually drive the Discovery to the charging station (page 5-4).
2. Start the timed actions (page 5-25).

6.3.5 Clean the Sensing Wheel

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).

Clean

1. Put the vehicle on its rear.
2. Use a brush to remove the dirt between the sensing wheel and the chassis.
3. Make sure the sensing wheel can turn freely.
4. Put the vehicle on its wheels.

Close-up

1. Manually drive the Discovery to the charging station (page 5-4).
2. Start the timed actions (page 5-25).

6.3.6 Clean the Manure Scraper

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).

Clean

To prevent damage of the electronics, do not clean the manure scraper with a high pressure cleaner!

1. Put the Discovery on its rear to access the manure scraper.
2. Clean the manure scraper with water and a brush (page 6-7).

Close-up

1. Clean the ultrasonic sensor (page 6-5).
2. Manually drive the Discovery to the charging station (page 5-4).
3. Start the timed actions (page 5-25).

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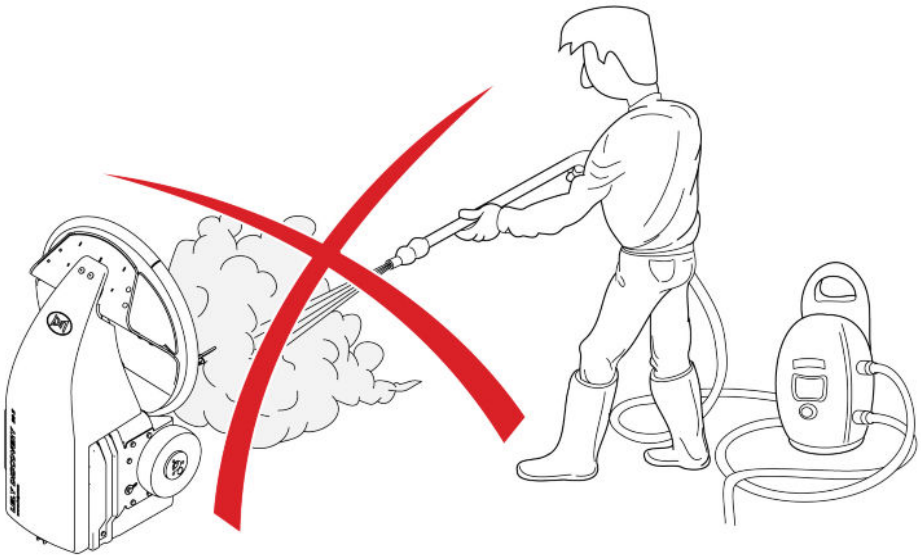

Figure 37. Do not clean the manure scraper with a high pressure cleaner

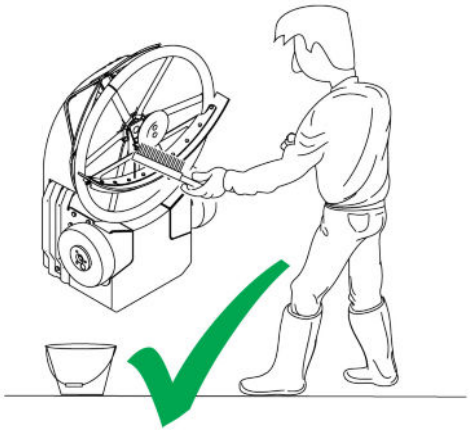

Figure 38. Clean the manure scraper with water and a brush

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6.3.7 Clean the Covers

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).
2. Remove the upper cover and store it in a safe place.

Clean

Do not spray water on the vehicle.

1. Clean the cover with water and a brush.

Close-up

1. Install the upper cover.
2. Manually drive the Discovery to the charging station (page 5-4).
3. Start the timed actions (page 5-25).

6.3.8 Tighten a Chain - short procedure

Danger of being entangled by rotating parts.
Keep hands, loose clothing and long hair away from moving parts during operation of the Discovery.

When a chain must be tightened for the third time, the extensive procedure must be done to prevent wearing of the chain's bearing points. Only a Lely certified technician is allowed to do the extensive procedure.

When it is unknown how many times a chain has been tightened, the extensive procedure must be done to prevent wearing of the chain's bearing points. Only a Lely certified technician is allowed to do the extensive procedure.

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).
2. Switch off (page 5-1) the Discovery.

Tighten a chain

1. Loosen the two bolts above the wheel (page 6-9) (1, 2). Do not remove the two bolts.
2. Put a ring spanner on the bolt in the slot (2).
3. Pull up the ring spanner to tighten the chain (2).
4. Tighten the bolt in the slot (2).
5. Tighten the other bolt (1).

Close-up

1. Switch on (page 5-1) the Discovery.
2. Open the Lely Control app on the smartphone.
3. Push [↵]

During the calibration process you must not move the Discovery.

4. Push soft button [**Yes**] to start the gyroscope calibration process.
5. Wait until a beep is heard (about 5 minutes) to confirm that the calibration is complete.
6. Manually drive the Discovery to the charging station (page 5-4).
7. Start the timed actions (page 5-25).

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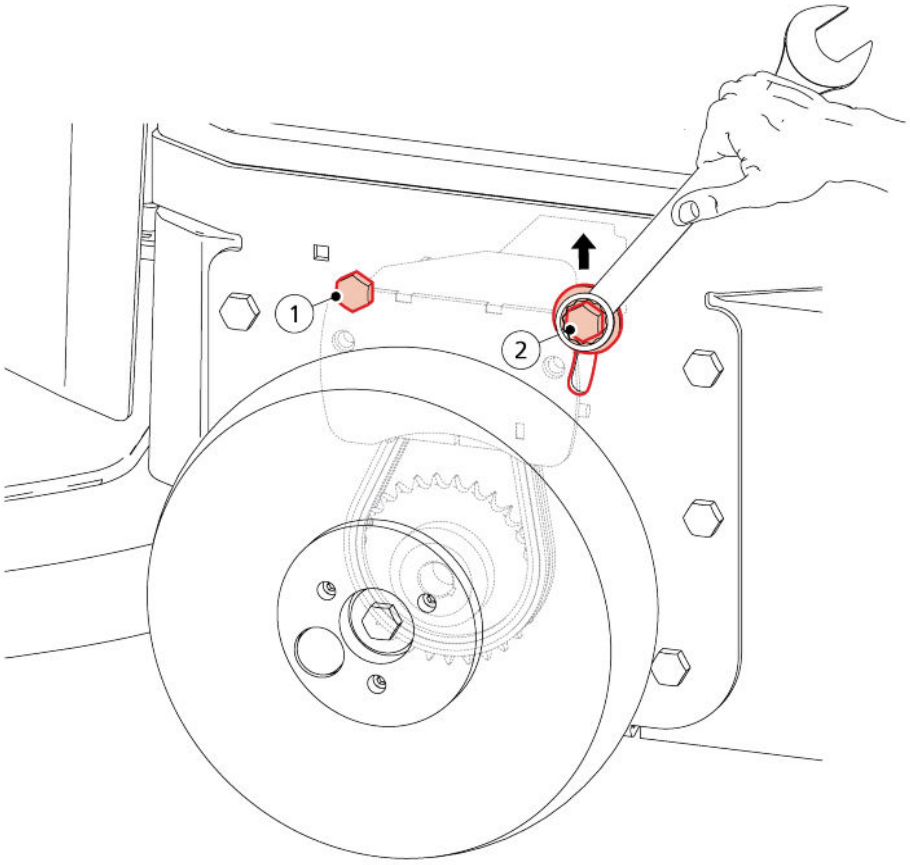

Figure 39. Tighten a chain - short procedure

6.3.9 Replace the Manure Scraper

Danger of being entangled by rotating parts.
Keep hands, loose clothing and long hair away from moving parts during operation of the Discovery.

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).
2. Switch off (page 5-1) the Discovery.

Removal

1. Lift the front of the Discovery and put the vehicle on its rear.

Make sure not to lose the bushing located inside the fixation plate and the bolts, washers and nuts through the openings of the slatted floor.

2. Release the bolt (page 6-11) (1) that attaches the sliding disk (2) and the top of the fixation plate of the scraper (9) to the nose of the Discovery.
3. Remove the sliding disk (2).
4. Remove the fixation plate (11) with the old manure scraper (4).
5. Clean the manure scraper.
6. Remove the ten bolts, nuts and washers (6,7,8) that attach the clamping strip (5) and the manure scraper (4) to the fixation plate (11).
7. Remove the clamping strip (5) and the manure scraper (4).

Installation

1. Loosely install the new manure scraper (4) between the fixation plate (11) and the clamping strip (5) with the ten bolts, washers and nuts (6,7,8).
2. Put the fixation plate (11) with the manure scraper (4) on a flat surface.
3. Make sure the manure scraper (4) is installed equally divided between the fixation plate (11) and the clamping strip (5).
4. Tighten all nuts (6).
5. Put the bushing (10) back inside the top of the fixation plate (9).
6. Install the sliding disk (2) and the fixation plate (11) with the manure scraper (4) on the nose with the bolt (1) and the self locking nut (3).
7. Make sure the self locking nut still locks. If not, install a new nut.

Close-up

1. Put the Discovery back onto its wheels.
2. Switch on (page 5-1) the Discovery.
3. Open the Lely Control app on the smartphone.
4. Push [↵]

During the calibration process you must not move the Discovery.

5. Push soft button [**Yes**] to start the gyroscope calibration process.
6. Wait until a beep is heard (about 5 minutes) to confirm that the calibration is complete.
7. Manually drive the Discovery to the charging station (page 5-4).
8. Start the timed actions (page 5-25).

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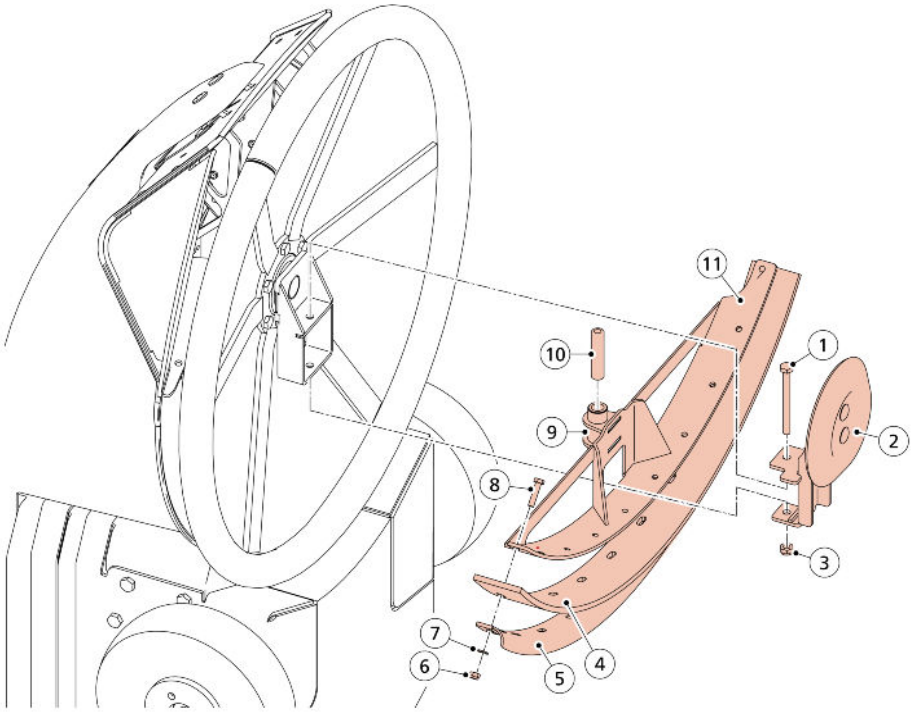

Figure 40. Replace the manure scraper

6.3.10 Replace the Sliding Disc

Preparation

1. Manually drive the Discovery to a clean and quiet location (page 5-3).
2. Switch off (page 5-1) the Discovery.

Removal

3. Lift the front of the Discovery and put the vehicle on its rear.

Make sure not to lose the bushing located inside the fixation plate ,the bolt and nut through the openings of the slatted floor.

4. Release the bolt (2) that attaches the sliding disk and the fixation plate (3) of the scraper to the nose of the Discovery.
5. Remove the sliding disk (1).
6. Remove the fixation plate (3) with the manure scraper.

Installation

7. Install the fixation plate (3) and the new sliding disk (1) with the bolt (2), the bushing and the nut.

Close-up

8. Put the Discovery back on its wheels.
9. Switch on (page 5-1) the Discovery.
10. Open the Lely Control app on the smartphone.
11. Push [↵]

During the calibration process you must not move the Discovery.

12. Push soft button [**Yes**] to start the gyroscope calibration process.
13. Wait until a beep is heard (about 5 minutes) to confirm that the calibration is complete.
14. Manually drive the Discovery to the charging station (page 5-4).
15. Start the timed actions (page 5-25).

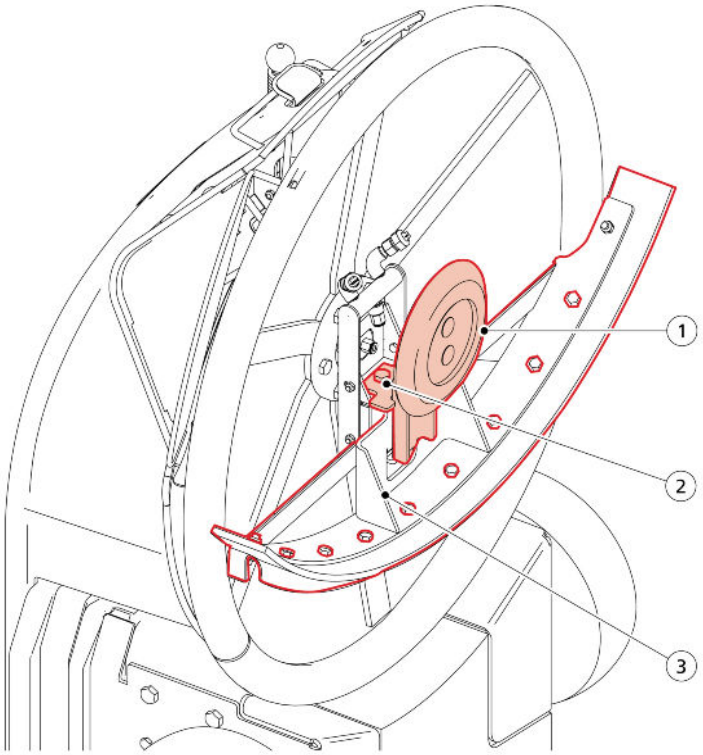

Figure 41. Replace the sliding disk

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7. TEST AND ADJUSTMENT

7.1 Introduction

This chapter contains the test- and adjustment procedures for the Discovery Mobile Barn Cleaner 90 SW.

Several options shown on the display of the user interface are not relevant for standard test and adjustment procedures, but may be useful for troubleshooting by your service provider.

7.2 Settings

7.2.1 Set the Real-Time Clock

1. Open (page 5-2) the Lely Control app on the smartphone
2. In the main menu of the Lely Control app, select 'Settings' and push button [↵].
3. Select 'RealTime clock' and push button [↵].
4. Push soft button [↓] to select a menu item (page 4-24).

The real-time clock has a 24 hour format. For instance 7:00 is not the same as 19:00.

5. Push [△] or [▽] to increase or decrease the value of the selected option.
6. Push button [ESC] to confirm and go to the previous menu.

7.2.2 Set the Display Language

1. Open (page 5-2) the Lely Control app on the smartphone
2. In the main menu of the Lely Control app, select 'Settings' and push button [↵].
3. Select 'Language' and push button [↵].
4. Push [△] or [▽] to select the display language.
5. Push button [ESC] to confirm and go to the previous menu.

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7.2.3 Set the Motor Power

1. Open (page 5-2) the Lely Control app on the smartphone
2. In the main menu of the Lely Control app, select 'Settings' and push button [↵].
3. Select 'Motor power' and push [↵].
4. Push [△] or [▽] to modify the power.
5. Push button [ESC] to confirm and go to the previous menu.

7.2.4 Modify the Beep Frequency for a Route

1. Open (page 5-2) the Lely Control app on the smartphone
2. In the main menu of the Lely Control app, select 'Routes' and push [↵].
3. Select 'Beepfreq route' and push [↵].
4. Select the route you want to modify and push [↵].
5. Push [△] or [▽] to modify the number of beeps per second.

The standard value 0.5 equals one beep per two seconds.

6. Push [ESC] to confirm and go one level up.

7.2.5 Modify the Beep Length

1. Open (page 5-2) the Lely Control app on the smartphone
2. In the main menu of the Lely Control app, select 'Settings' and push button [↵].
3. Select 'Beep length'.
4. Push button [△] or button [▽] to modify the length (page 4-24).

The standard value is 200 mSec.

5. Push button [ESC] to confirm and go to the previous menu.

7.2.6 Set the Water Fill Settings

1. Open (page 5-2) the Lely Control app on the smartphone
2. In the main menu of the Lely Control app, select 'Settings' and push button [↵].
3. Select 'Fill water' and push [↵].

To set the push power

1. Select 'Push power'.
2. Push [△] or [▽] to modify the drive motor current (page 4-25).

To set the water pump power

1. Select 'Pump current'.
2. Push [△] or [▽] to modify the water pump current (page 4-25).

To set the water fill function 'On' or 'Off'

1. Select 'Water in use'.
2. Select 'On' or 'Off' (page 4-25).

Close-up

1. Push button [ESC] to confirm and go to the previous menu.

7.3 Tests

7.3.1 Analyse the Reliability of a Route

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Routes' and push [↵].

To Analyse the Reliability per Route

1. Select 'Route analysis' and push [↵].
2. Select 'Fail. problty' and push [↵].

Push [↵] or [**ESC**] to display routes that are not displayed

1. If a route has a failure probability of more than 2 (page 4-20),
   1. Make a note of the route number.
2. Push [**ESC**] to go one level up.

Because a route can not been modified, you have to delete an unreliable route and to make a new one. Before doing so it is good to figure out what is wrong.

To Analyse the Cause of an Unreliable Route

1. Select 'Failure analys' and push [↵].
2. Select the noted route number and push [↵].
3. Make a note of the fault categories (A-E) that have an (action) number and note the numbers (page 4-20).
4. Push [↵] and make a note of the fault categories (F-H) that have an (action) number and note the numbers.
5. Make a note of the percentage bump points (page 4-20).

6. Make a note of the percentage short routes (page 4-20).
7. Push [↵] and look up the explanation of the noted fault categories (A-H).
8. Make sure you understand the explanation of the noted fault categories.
9. Make a test route and find out where the notes risky action numbers appear (page 7-4).
10. Delete the route.
11. Make a new route (page 4-13).

7.3.2 Test a Route

1. Put the route into a manual route.
2. Start the manual route (page 5-25).
3. Find the actions and action numbers on the display of the user interface of the Lely Control app.
4. Make sure the route is correct.

7.3.3 Make sure the Battery is Loaded

1. Stop all timed actions (page 5-25).
2. In the main menu of the Lely Control app, select 'Work' and push [↵].
3. Make sure the battery voltage is more than 12500 mV.
4. If the voltage is less then 12500 mV:
   1. Manually drive the Discovery to the charging station (page 5-4).
   2. Make sure the battery is charging (page 7-4).
5. Charge the battery for one hour.

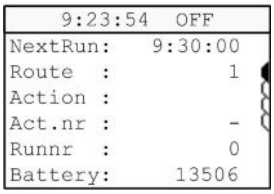

Figure 42. Battery voltage

7.3.4 Make sure the Battery is Charging

1. Make sure the Discovery is connected to the charging station.
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Work' and push [↵]. (three times).
4. Make sure the menu MANUAL CHARGER is displayed.
5. Make sure the charging current is more than 1.0 A.
6. If the charging current is less than 1.0 A, make sure the orange LED on the charging station is ON (page 4-8).

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7. If not, make sure the main power is connected to the battery charger.
8. If the Discovery is still not charging, make sure the electrodes are connected to the battery charger.
9. If the Discovery is still not charging, clean the charging strips and the electrodes (page 6-2).
10. If the Discovery is still not charging, make sure all power connection are connected properly.
11. If the Discovery is still not charging, call the local service provider.

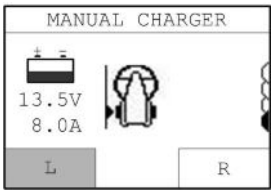

Figure 43. Charging current

7.3.5 Make sure the Bluetooth Connection is Reliable

1. Start the Lely Control app on the smartphone.
2. Connect the smartphone to the Discovery.
3. Push the button 'Settings' at the bottom of the smartphone display.
4. Select 'Signal Strength'.
5. Examine the value of the signal of the Discovery.
   - 0 = very good
   - -20 - -25 = poor
   - < -25 = very bad

7.3.6 Test the Ultrasonic Sensor

Test

1. Manually drive the Discovery to a location more than 6 m (6.6 yrd) from a wall.
2. Make sure no object is between the ultrasonic sensor and the wall.
3. In the main menu of the Lely Control app select 'Test'and push [↵].
4. Select 'Ultrasound' and push [↵].
5. If the ultrasonic sensor is on the left, push soft button [**L**], else push [**R**].
6. Make sure the Discovery is between you and the wall.

Make sure not to interrupt the sensing beam while turning the wheel.

7. Monitor the display of the user interface while you turn the sensing wheel.
8. Make sure the 'Puls 1',' Puls 2', 'Puls 3' and 'Filter' values are 0, when the wheel is rotating.
9. If the values are not 0, clean the ultrasonic sensor with a tissue.
10. Repeat the steps 7 and 8.
11. If the values are not 0, call your local Lely service provider.
12. If the puls and filter values are 0,
    1. Put an object exactly 1 m. (1.1 yrd) from the ultrasonic sensor.
    2. Make sure the Puls 1 and Filter show 1000 (mm).

Else call your local service provider.

Close-up

1. Manually drive the Discovery to the charging station (page 5-4).
2. Start the timed actions (page 5-25).

Figure 44. Test the ultrasonic sensor

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8. TROUBLESHOOTING

8.1 Introduction

This chapter contains the troubleshooting procedures for the Discovery.

- Alarms and reports
- Troubleshooting table
- Recovery procedures.

8.2 Alarms and Reports

The Discovery Mobile Barn Cleaner 90 SW monitors itself continuously. As soon as it detects an error it generates a message, the system also generates and displays reports with important information:

- A critical alarm message: 3 beeps sound and the Discovery stops functioning. The user interface on the smartphone displays the message "ALARM" with a description (page 8-1). The error requires an error recovery procedure.
- A non-critical report is recorded in the report list, the Discovery continues functioning (page 8-9).

The system also displays information about the operation of the Discovery (page 8-11).

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8.2.1 Recover alarms

When the Discovery is in normal operation and a critical alarm occurs:

- An alarm message is displayed on the smartphone.
- The LED in the pause button on the Discovery blinks.
- An alarm sounds.

To recover the critical alarm:

1. Push any key on the smartphone to accept the alarm. The alarm sound stops. The LED in the pause button still blinks.

8.2.2 Read Non-Critical Alarm Messages

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Alarms' and push [↵].
4. Push [↵] to select the menu 'Alarm List'.

The display displays the number, the date and time when the alarm occured and the alarm number, see the following example:

No.	Date	Time	Alarm
1	4-1	22:17	7
2	4-1	21:33	10

Select an alarm in the list and push [↵] to open the alarm message for extra information.

5. Note the alarm number and refer to the alarm list (page 8-1).
6. Do the recovery procedure described in the alarm list.

8.2.3 Read a Report

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. In the main menu of the Lely Control app, select 'Alarms' and push [↵].
4. Select 'Report list' and push [↵] .

The display displays the number, the date and time the report was recorded and the report number, like in the following example:

No.	Date	Time	Rep
1	4-1	20:10	6
2	4-1	21:31	15

Select a report in the list and push [↵] to open the report message for extra information.

5. Note the report number and look it up in the report list (page 8-9).
6. Do the indicated procedure.

8.2.4 Alarm List

The table below gives the alarm numbers and any actions to be taken:

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Alarm code	Alarm message	Description / cause	Recovery procedure
1	EMPTY_BATTERY "Battery power too low to start route, charge first! " Check charge strip for dirt	• Bad contact with battery charger due to dirt and/or corrosion. • Loose connections. • Before the start of a route the level is too low.	1. Clean the charging strips and the charging electrodes (page 6-2). 2. Manually drive the Discovery to the charging station (page 5-4). 3. Make sure the battery is charging (page 7-4). 4. If the Discovery is still not charging, call your local service provider.
2	DOUBLE_ACTION	• Software failure.	1. Call your local Lely service provider.
3	DIS_OFF_RANGE Discovery lost -> searching bump point Slip: reduce - wall bump force - motor power	• No bump point found.	1. Calibrate the gyroscope (page 8-15). 2. Test the route (page 7-4). 3. If the problem remains: 1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable. 1. Test the route (page 7-4). 2. If the problem remains, call your local Lely service provider.
4	TURN BLOCK Discovery can not take the turn!	• Mechanical problem, worn parts, dirt causing resistance. • Vehicle has not turned far enough.	1. Make sure there are no obstacles. 2. Make sure the sliding disc is not worn out, replace if necessary. 3. Make sure the manure scraper is not worn out, replace if necessary (page 6-9). 4. If the problem remains: 1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable.
5	NO TIME No active time!	• Time path is empty	1. Set the time path and try again.
6	BLOCKAGE_DISC . Discovery blocked!!	• Obstacle. • Gyroscope inaccurate.	1. Make sure there are no obstacles. 2. Try to run the route again. 3. If the discovery is blocked on the same. place: 1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable. 1. If the discovery is blocked at a different place, calibrate the gyroscope (page 8-15).

Alarm code	Alarm message	Description / cause	Recovery procedure
7	DISCOV_LOST Discovery deviates from correct directn! Slip: reduce - wall bump force - motor power	• While turning, the vehicle did not reach the programmed position and not even after retrying.	1. Make sure there are no obstacles. 2. Calibrate the gyroscope (page 8-15). 3. Test the ultrasonic sensor (page 7-5). 4. Test the motors. 5. Start the timed actions. 6. If the problem remains: 1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable. 1. If the problem remains, call your local Lely service provider.
8	TURN ERROR Discovery turns more than 360 deg! - Check gyroscope - Calibrate via menu Settings	• More than 360 degree turn.	1. Calibrate the gyroscope (page 8-15).
9	LOADING No charging current! Check charge strips for dirt	• Discovery does not reach the charging station.	1. Make sure there are no obstacles. 2. Clean the charging strips and the charging electrodes (page 6-2). 3. Manually drive the Discovery to the charging station (page 5-4). 4. Make sure the battery is charging (page 7-4). 5. If the Discovery is still not charging, call your local service provider.
10	STARTUP		Alarm appears with every startup of the Discovery. For information only.
11	ROUTE-MEMORY Route memory is full. First delete one route!!	• Route memory has reached the maximum of 16 different routes.	1. Delete a route prior to programming a new one.
12	NO_ULTRASIGN No ultrasound signal: - dirt on sensor - dirt sensing wheel - no object	• Dirt on the ultrasonic sensor. • Dirt on sensing wheel. • No object within reach of the sensor. • Sensor broken.	1. Clean the ultrasonic sensor (page 6-5). 2. Clean the sensing wheel. 3. Test the ultrasonic sensor (page 7-5).

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Alarm code	Alarm message	Description / cause	Recovery procedure
13	BENDSKIDDING Discovery skid in the turn!	• Although the motors did run, de gyroscope did not observe any rotation, not even after retrying.	1. Make sure the floor is not slippery. 2. Make sure the wheels are not worn out. If so, call your local service provider. 3. Make sure the manure scraper is not worn out, replace if necessary (page 6-9). 4. Test the route (page 7-5). 5. If the problem remains, call your local Lely service provider.
14	EXTRA CHARGE1		Voltage is too low, the Discovery recharges for an extra hour. For information only.
15	EXTRA CHARGE2		More than 20Ah used. For information only.
16	EXTRA READY1		Recharging is complete. For information only.
17	EXTRA READY2		Recharging is complete. For information only.
18	CHARG TIMEOUT Timeout charger: battery not charging! Check charge LEDs on charger and clean charge strips	• Battery not full despite charging.	1. Clean the charging strips and the charging electrodes (page 6-2). 2. Manually drive the Discovery to the charging station (page 5-4). 3. Make sure the battery is charging (page 7-4). 4. If the problem remains, call your local Lely service provider.
19	DOUBLE TIME Similar points in time exist!		1. Correct the start and end times in the time path.
20	BATTVOLT LOW Battery power too low to start route! Drive Discovery to charger or clean charge strips!		1. Clean the charging strips and the charging electrodes (page 6-2). 2. Manually drive the Discovery to the charging station (page 5-4). 3. Make sure the battery is charging (page 7-4). 4. If the problem remains, call your local Lely service provider.

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21	SKIDDING. WFL	• Skidding (the angle calculated from wheel distance and angle from gyro differ) during straight, wallfollow or ultrasonic actions.	1. Make sure the floor is not slippery. 2. Make sure the wheels are not worn out, replace if necessary. 3. Make sure the manure scraper in not worn out, replace if necessary. 4. Test the route.
22	SKIDDING_STOP	• The Discovery stopped because alarm 13 was generated multiple times.	1. Make sure the scraper is not worn or damaged. Replace if necessary (page 6-9). 2. Manually run the route again. 3. If the problem remains, decrease the motor power.
23	HEAVY DRIVE Discovery drives hard!!	• The Discovery has difficulties driving the route.	If the alarm is repeated more that 5 times per week: 1. Make sure there are no obstacles. 2. Make sure the barn bedding has no long hay. 3. If the problem remains: 1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable.
24	FLASH-ERROR		1. Call your local Lely service provider.
25	SHORT-CIR. 1L		1. Call your local Lely service provider.
26	SHORT-CIR. 2R		1. Call your local Lely service provider.
27	BACKUP ERROR Error backup: Try again!	• Smartphone is not connected. • Software on the smartphone is not correct. • Smartphone is defect. • Not enough storage space.	1. Make sure the smartphone is connected via bluetooth. 2. Make sure to use the correct version of the Lely Control app. 3. Free up storage space. 4. Try to make another backup. 5. If the problem remains, call your local Lely service provider.
29	NO_GYRO_START		1. Call your local Lely service provider.
30	M1 THERMISCH Motor 1 thermic out	• Current left motor too high, probably due to dirt or worn parts.	1. Remove any dirt or obstacles. 2. Make sure there are no worn parts (manure scraper, sliding disk).

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31	M2 THERMISCH Motor 2 thermic out	• Current right motor too high, probably due to dirt or worn parts	1. Remove any dirt or obstacles. 2. Make sure there are no worn parts (manure scraper, sliding disk)
32	COOL DOWN	• Discovery pauses to cool down the motors.	1. Remove any dirt or obstacles. 2. Make sure there are no worn parts (manure scraper, sliding disk). 3. If the alarm is repeated more than 5 times a week, call your local Lely service provider.
33	FULL CHARGING	• Not enough charging time between routes. The Discovery must recharge fully during nighttime.	1. Modify the routes. 2. Make sure the time period between the routes is long enough to fully recharge the battery.
35	BATT ERROR	• Battery recharge failed, too low charging current • Bad contact with battery charger due to dirt and/or corrosion. • Loose connections.	1. Clean the charging strips and the charging electrodes. 2. Make sure the battery is charging. (page 7-4)
37	GYROANGLEFACT		1. Call your local Lely service provider.
38	LOADING2 No charging current! Check charge strips for dirt	• Bad contact with battery charger due to dirt and/or corrosion. • Loose connections	1. Clean the charging strips and the charging electrodes (page 6-2). 2. Make sure the battery is charging. 3. Charge the Discovery.
39	GYRO_TEMP		1. Call your local Lely service provider.
41	COM_BATTCHAR2	• Gyro calibration failed.	1. Try again.
43	BATTERY_STOP Discovery battery runs down. Switch off or charge Discovery	• More than 24 hours not charged or started a route. • The Discovery stops and beeps for 1 hour.	1. Clean the charging strips and the charging electrodes (page 6-2). 2. Make sure the battery is charging 3. Charge the Discovery (page 8-15).
44	BATT_FATAL_ER		1. Call your local Lely service provider.
45	GYRO_TYPE		1. Call your local Lely service provider.
47	GYRO_AUTOSTOP	• Automatic gyro recalibration has been interrupted	1. Recalibrate the gyroscope in settings menu.
48	BATTERY_OFF	• After 1 hour of alarm #43, the Discovery will power off to protect the battery.	1. Clean the charging strips and the charging electrodes (page 6-2). 2. Make sure the battery is charging. 3. Charge the Discovery (page 8-15).

49	BATTERY_CABLE Loader error! Check cable connections		1. Manually drive the Discovery to a clean and quiet location (page 5-3). 2. Make sure the charging wires are connected correctly to the battery.
50	DIRECTION_DIS Discovery not in correct direction! - obstacle - gyro drifting - bend in action		1. Make sure there are no obstacles. 2. Calibrate the gyroscope (page 8-15). 3. Test the ultrasonic sensor (page 7-5). 4. Test the motors. 5. If the problem remains: 1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable.
52	ULTRAS_CALIB		1. Call your local Lely service provider.
53	CALIBR_I_PCB		1. Call your local Lely service provider.
54	CLOCK ERROR The 24 hours clock is not correct -> adjust the time!!	• Internal clock is not set.	1. Make sure the real-time clock is set in the correct 24 hour format. 2. Make sure all start and end times in the time path are entered in the correct 24 hour format. 3. Correct the clock or the start and end times if necessary.
55	BACKUP ERROR2	• No backup on the Smartphone	1. Make a backup.
56	SHORT-CIR. 34		1. Call your local Lely service provider.
57	GYRO_SPI		1. Call your local Lely service provider.
58	GYRO_I_INSTAB		1. Call your local Lely service provider.
59	GYRO_TIMEOUT		1. Call your local Lely service provider.
60	GYRO BIAS1		1. Call your local Lely service provider.
61-64	GYRO BIAS2 - 5		1. Call your local Lely service provider.
65	Gyroscope type does not match output signal!! Reset PCB		1. Switch off the Discovery and wait at least 10 seconds. 2. Switch on the Discovery. 3. If the problem remains, call your local Lely service provider.
66	Gyro heater current is not 0!		1. Call your local Lely service provider.

70	DIS_OFF_RANGE Discovery lost -> searching bump point Slip: reduce - wall bump force - motor power	• No bump point detected after expected bump point.	1. Wait for the Discovery to correct itself.
73	NO_ULTRASIGN No ultrasound signal: - dirt on sensor - dirt sensing wheel - no object	• Appears when alarm 12 is not resolved	1. Clean the ultrasonic sensor (page 6-5). 2. Clean the sensing wheel (page 6-6). 3. Make sure an object is within 2.5 m (8.2 ft). 4. Test the ultrasonic sensor (page 7-5). 5. If there is still no signal, call your local Lely service provider.
77	EXTRA CHARG3	• Battery Discovery has insufficient capacity to complete the route	
78	EXTRA READY3	• Battery is charged enough to start the route.	
80	Emergency button pushed		1. Call your local Lely service provider.
84	Hardware safety protection		1. Call your local Lely service provider.
89	FPGA error		1. Call your local Lely service provider.
90 - 98	Software 1-5 Software FAILURE Call Lely!		1. Call your local Lely service provider.
120	Unexpectedly in water filling station (90SW)		1. Call your local Lely service provider.

8.2.5 Report List

The table below gives the report numbers and any actions to be taken:

Report code	Report	Description/Procedure
2	Left chain is slack. Check chain tension	1. Make sure the chain can move 5 mm up and down. 2. If not, tighten the chain (page 6-8).
3	Right chain is slack. Check chain tension	1. Make sure the chain can move 5 mm up and down. 2. If not, tighten the chain (page 6-8).
4	Left tire has a smaller diameter. Route less reliable!!	1. Call your local Lely service provider.

Report code	Report	Description/Procedure
5	Right tire has a smaller diameter. Route less reliable!!	1. Call your local Lely service provider.
6	Drive distance increases Check skid. Route less reliable!!	1. Make sure the floor is not slippery. 2. Make sure the Discovery does not skid.
7	Ultrasonic sensor gives too many reflec Check startpulse Clean ultrason sensor Clean sensing wheel	1. Clean the ultrasound sensor and the sensing wheel (page 6-5). 2. If the problem remains, call your local Lely service provider.
8	Ultrasonic sensor gives too many reflec Check startpulse Clean ultrason sensor Clean sensing wheel	1. Clean the ultrasound sensor and the sensing wheel (page 6-5). 2. If the problem remains, call your local Lely service provider.
9	Left motor drives harder than the right motor -> check the drive	1. Call your local Lely service provider.
10	Right motor drives harder than the left motor -> Check drive	1. Call your local Lely service provider.
11	Low charging current! -Clean chargingstrips -Check charger	1. Manually drive the Discovery to the charging station (page 5-4). 2. Clean the charging strips and the charging electrodes (page 6-2). 3. Make sure the battery is charging (page 7-4).
12	The charging current is too low, check connection points and power	Refer to report 11.
13	Battery condition bad Install a new battery	1. Install a new battery (operator is NOT allowed to open the PCB box).
14	Battery is overloaded too many times See battery yield and check battery and capacity	Vehicle drives back 20 cm automatically to protect the battery. 1. Call your local Lely service provider.
15	"Battery power too low to start route, charge first! "	1. Clean the charging strips and the charging electrodes (page 6-2). 2. Charge the Discovery (page 8-15).
16	Battery power too low to start route! Drive Discovery to charger or clean charge strips!	1. Clean the charging strips and the charging electrodes (page 6-2). 2. Charge the Discovery (page 8-15).
17	Discovery is not finished with test route. Please switch on the route.	1. Call your local Lely service provider.
18	Battery condition deteriorates. Check battery	1. Call your local Lely service provider.
19	The current of the batt is low when the Discovery drives	1. Call your local Lely service provider.

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Report code	Report	Description/Procedure
20	Bad signal of ultrasonic sensor-> clean: - ultrasonic sensor - sensing wheel	1. Clean the ultrasonic sensor and the sensing wheel (page 6-5).
21	Route is not correct - unreliable - see route analysis - see manual	1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable.
34	Battery is charged The charge cyclus is complete	For information only.
40	The factory route is complete.	For information only.
50 - 55	Battery is overloaded too many times See battery yield and check battery and capacity	1. Call your local Lely service provider.
60	Ultrasonic sensor gives too many reflec Check startpulse Clean ultrason sensor Clean sensing wheel	1. Clean the ultrasonic sensor and the sensing wheel (page 6-5). 2. Test the ultrasonic sensor (page 7-5). 3. If the problem remains, call your local Lely service provider.
61	Bad signal of ultrasonic sensor-> clean: - ultrasonic sensor - sensing wheel	1. Clean the ultrasonic sensor and the sensing wheel (page 6-5).
62	Gyroscope values deviate ->check drift!	1. Calibrate the gyroscope (page 8-15). 2. If the problem remains: 1. Do a route analysis (page 7-3). 2. Modify the routes that are unreliable.

8.2.6 Information Report List

The table below gives the reports that are not recorded and any actions to be taken:

Description	Explanation
Timepath contains x % drive time	The Discovery must not drive more than 40% of the total time in a time path. It must spend minimum 60% of the total time charging at the charging station.
Not enough bump points in route: % Low reliability of of the route!!	At least 25% of the actions in a route must have a bump point. If not, the route is less reliable.
Too many actions in one route. Not possible to finish the route!!	The number of actions in the present route is more than the maximum 125. You must start again, break up the route in smaller parts.
You have the possibility to program x actions in this route!!	Gives you the number of actions left in the present route until the maximum 125 is reached.

ERROR: timepath contains % of the drive time. Max 40%	The Discovery must not drive more than 40% of the total time in a time path. It must spend minimum 60% of the total time charging at the charging station. Delete some routes from the time path
NOTE: bump points! Program as much as possible bump points PR-button==slowly Discovery auto stop	For information only.
NOTE: Gyroscope! End actions straight Alternate long action with short action	For information only.
Is Discovery nose in the correct direction?	Manually turn the vehicle in the correct direction with Manual Drive (page 5-3) if the direction is not correct.
At start ultrasound action, Discovery was not pointing in the intended direction Route less reliable!!	Angle of more than 20 degrees between the start and the reset point. This could be due to an angled start point. Refer to Failure Analysis (page 4-20).
ERROR: Distance correction on exist routes -> check on skid during drive	The control system has corrected the drive distance because the expected bump point was not reached in time. This could be due to skidding. Refer to Control System.
Direction ERROR - Action with bends - Gyroscope drifting Route is not reliable!!	The driving direction is not reliable. This could be due to a drifting gyroscope or to a programmed action that did not follow a straight course. Refer to Failure Analysis (page 4-20).
12 standard turns Switch between the 4 screens with Enter and Escape!	You can choose from 12 standard turns that are displayed on 4 screens. Push [↵] to open the next screen, or [**ESC**] to go one level up.

8.3 Troubleshooting Tables

8.3.1 Troubleshooting Table Discovery Vehicle

Symptom	Possible cause	Action
The smartphone does not connect to the Discovery / connection lost	The farmer password is not set on the smartphone	Ask the Lely service provider for the password, see install or update the app (page 5-1).
	The smartphone is not paired with the Discovery.	1. Make sure bluetooth of the smartphone is switched on. 2. Examine in the bluetooth settings of the smartphone if the Discovery is paired. If not, try to pair (PIN = '0000'). Refer to the user manual of the smartphone.
	The Discovery is switched OFF	Switch ON the Discovery (page 5-1)
	The distance between the smartphone and the Discovery is too big	Move the smartphone towards the Discovery and try to connect (page 5-2)

Symptom	Possible cause	Action
The vehicle does not move	Discovery is switched OFF	Switch ON the Discovery (page 5-1) Start the timed actions (page 5-25)
	The route is blocked	Remove the blockade
	The battery is low	Drive the Discovery to the charging station (page 5-4) Charge for one hour
	The fuse is blown	Call your local Lely service provider.
	The power supply is not connected	Connect the power supply
	Other	Call your local Lely service provider.
The Discovery drives more shaky than before	The chains are not tightened correctly	Tighten the chains (page 6-8)
	The wheel bearing is worn out	Call your local Lely service provider.
Discovery swings	The gyroscope is drifting	Calibrate the gyroscope (page 8-15)
	The ultrasonic sensor does not function correctly	Clean the ultrasonic sensor (page 6-5) Test the ultrasonic sensor (page 7-5)
	Other	Call your local Lely service provider.
Discovery does not stop at the charging station	The charging strips or electrodes do not make contact	Clean the electrodes and charging strips (page 6-2)
	No power supply	Make sure the charging station is connected to the power supply.
	Springs that hold the electrodes are loose	Attach the springs properly
	The 'Go to the charger' action is not started within 1-3 meters from the charger (page 5-21)	• Modify the route • Delete the route • Setup a new route
	The battery charger is out of operation and gives an alarm signal	Remove any dirt. Disconnect the mains for 30 s and connect again.
Discovery does not stop at a bump point	Floor is less slippery than before	Adjust the motor power to a lower level
	Other	Call your local Lely service provider.
	Bad route	Modify the route
Discovery does not fill water	Water filling function switched Off	Switch On the water filling function (page 5-4)
	Water supply disrupted	Make sure the water filling station supplies water when you push against the water outlet. If the water filling station does not supply water: Call your local Lely service provider.

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Symptom	Possible cause	Action
The backup process of the routes does not function	The software version of the smartphone is not correct.	Make sure software version on the smartphone is correct. If the version is not correct update the smartphone software.
Discovery is not starting a route	The time path is not correct	Make sure the time path is correct
	The battery is low or not charged	Drive the Discovery to the charging station (page 5-4)
	The route is blocked	Unblock the route
	No route is programmed	Program a short test route and try again
	Other	Call your local Lely service provider.

8.3.2 Troubleshooting Table Discovery Charging Station

Symptom	Possible cause	Action
Green and Yellow LED together blink 2 times, followed by a few seconds rest	Battery loader defect	Call your local Lely service provider.
Green and Yellow LED together blink 4 times, followed by a few seconds rest	Temperature lower than - 15 degrees C (5 degrees F)	Warm the barn and try again.
	Battery loader defect	Call your local Lely service provider.
Green and Yellow LED together blink 5 times, followed by a few seconds rest	Internal temperature is higher than 85 degrees C (185 degrees F)	Remove plug from the mains. Connect plug and retry after one hour.
Green and Yellow LED together blink 7 times, followed by a few seconds rest	Current too high (>20 A).	Remove short-circuit, else: Call your local Lely service provider.

8.4 Recovery Procedures

8.4.1 Reset the Control System

1. Open (page 5-2) the Lely Control app on the smartphone
2. Manually drive the Discovery away from the charging station (page 5-3).
3. Remove the upper cover.
4. Remove the lower cover.
5. On the PCB box, push button OFF .
6. On the PCB box, push button ON .
7. Calibrate the gyroscope.
8. Manually drive the Discovery to the charging station (page 5-3).

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8.4.2 Calibrate the Gyroscope

1. Open (page 5-2) the Lely Control app on the smartphone
2. Stop all timed actions (page 5-25).
3. Select 'Settings' and push [↵].
4. Select 'Gyroscope'.
5. The message 'SAFETY WARNING. Manual operation is permitted only with a clear overview of the vehicle. Confirm?' appears on the smartphone display. Confirm if you have a clear overview of the Discovery.

Do not move the Discovery.

6. Push soft button [Yes] and wait until you hear a beep sound (approximately 5 minutes).

8.4.3 Charge the Discovery

1. Manually drive the Discovery to the charging station (page 5-4).
2. Make sure the Discovery is charging (orange and green LEDs are ON (page 4-8)).
3. Let the Discovery be charged for one hour minimum.

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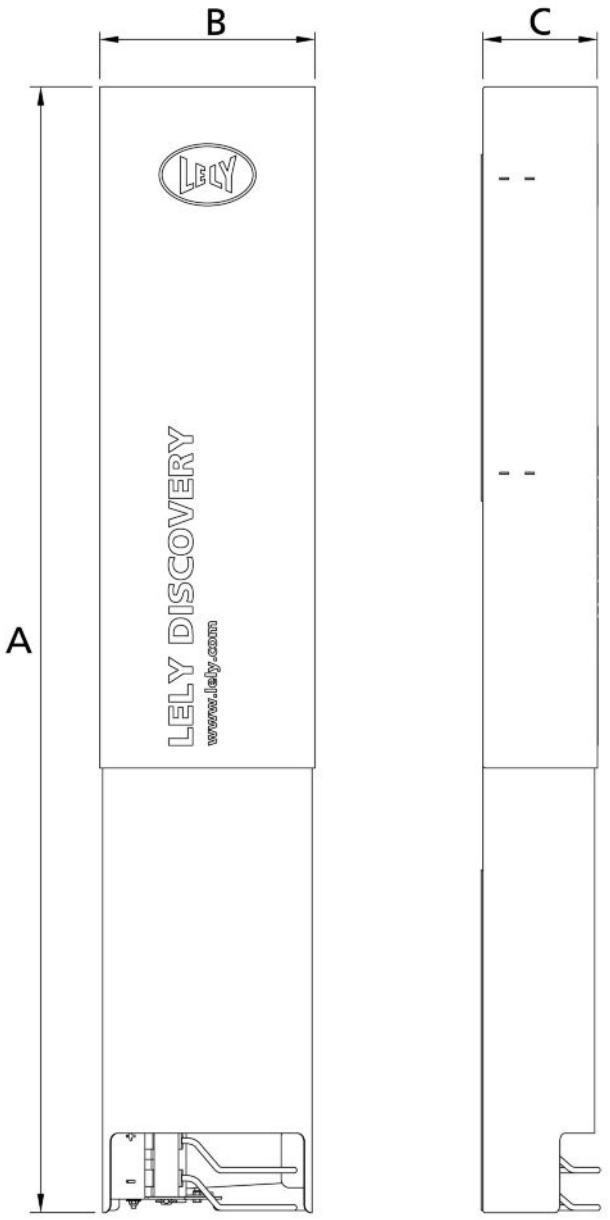
9. DIAGRAMS



KEY:
A. 1650 - 2050 mm (65.0 - 80.7 in.) - B. 380 mm (15.0 in.) - C. 220 mm (8.7 in.)

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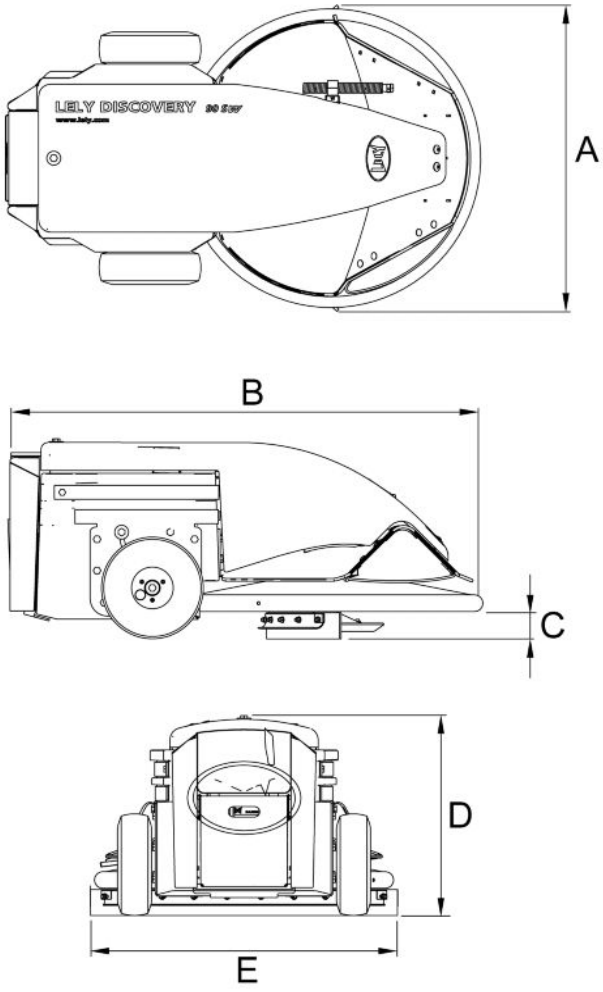

KEY:
A. 860 mm (33.86 in.) - B 1362 mm (53.6 in.) - C. 102 mm (4.02 in.) - D. 575 mm (22.64 in.) - E. 860 mm (33.9 in.)

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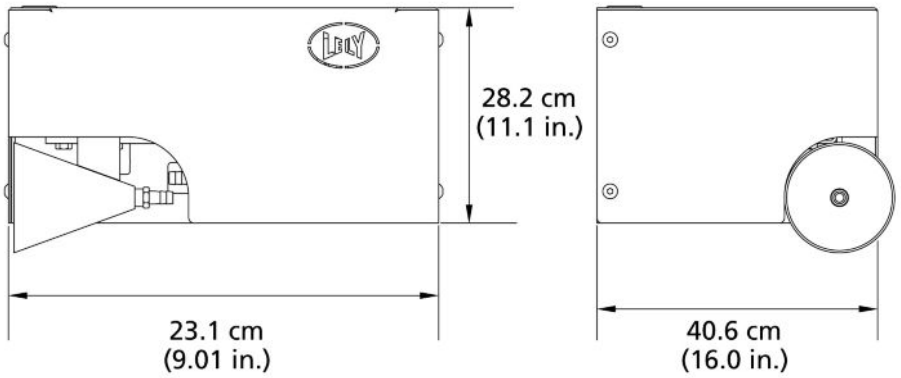

Figure 45. Dimensions water filling station

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GLOSSARY OF TERMS

action: building block for a cleaning route, for instance wall following or turning

alarm: alarm message on the smartphone display that requires an error recovery procedure

Android: operating system for smartphones and tablet computers.

approx: approximately

Astronaut: Lely Astronaut A4 milking robot

bump point: a straight collision with the wall on slow speed enabling the control system to correct itself

cm: centimeter

encoder: electronic device to measure the number of rotations

EU: European Union

gyroscope: electronic device for measuring or maintaining orientation

in: inch

kg: kilogram

lb: pound

LED: Light Emitting Diode

long action: driving with contact with the wall, Wall Flw L, Wall Flw R or Ultrasound L for more than 10m, enabling the control system to correct itself

m: metre

mA: milliAmperes

manual route: (series of) routes that can be started manually

manure scraper: flexible strip, installed under the Discovery to clean the floor

PCB: printed circuit board with electrical components.

report: message on the smartphone display that informs you about the status of the Discovery or actions to be taken

route: route through a (part of a) barn for cleaning

route analysis: built-in function to analyse the probability of failures per route and to indicate the actions that causes the risk

short action: driving without contact with the wall, Straight, Turn L <-- or Turn R -->

Lely Control app: Control software on a smartphone, used to adjust the settings or manually control the installation.

time path: 24 hour time schedule with 48 routes maximum

ultrasonic sensor: electronic device for measuring the distance to an object

V: Volt

VAC: Voltage in Alternating Current

VDC: Voltage in Direct Current

yd: yard (36 inches)

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LELY INDUSTRIES N.V.
Cornelis van der Lelylaan 1
NL-3147 PB Maassluis
Tel +31 (0)88 - 12 28 221
Fax +31 (0)88 - 12 28 222
www.lely.com